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NUREG–2222

Disposition of Public Comments on the Draft Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192

Office of Nuclear Reactor Regulation

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NUREG–2222

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ABSTRACT

This document is a knowledge management and knowledge transfer document associated with NUREG–2191, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report,” and NUREG–2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (SRP-SLR).

This document contains the U.S. Nuclear Regulatory Commission (NRC) staff’s analysis of the public comments received on the drafts of NUREG–2191 and NUREG–2192. Public comment drafts of the GALL-SLR Report and the SRP-SLR were published on December 15, 2015, with the public comment period expiring on February 29, 2016. A supplement to the draft subsequent license renewal guidance documents was published on March 29, 2016, with the public comment period expiring on May 31, 2016. The disposition of comments that the NRC staff agreed with and used as the basis for instituting a change to either the GALL-SLR Report or the SRP-SLR are detailed in this document. In addition, the public comments that did not result in a change to either NUREG are also dispositioned, and the staff’s technical basis for not agreeing with these comments is presented.

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EXECUTIVE SUMMARY

Public Comment Overview

On December 23, 2015 (80 FR 79956), the U.S. Nuclear Regulatory Commission (NRC) announced the issuance and availability of the following subsequent license renewal (SLR) guidance documents for public comment:

- Draft "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (NUREG–2191),
- Draft "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (SRP-SLR) (NUREG–2192)

On March 29, 2016, a supplement to the draft SLR guidance documents was published, with the public comment period expiring on May 31, 2016. These SLR guidance documents described methods acceptable to the staff for implementing the license renewal rule, Title 10 of the *Code of Federal Regulations* (10 CFR) Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," as well as techniques used by the staff in evaluating applications for nuclear power plant (NPP) license renewals. The draft revisions incorporated changes that reflected past precedents and other lessons learned since Revision 2 of NUREG–1801, "Generic Aging Lessons Learned (GALL) Report," and NUREG–1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," published in 2010.

In addition to issuing the draft revisions of these SLR guidance documents for formal public comment, the staff held several public meetings with stakeholders to discuss the content of the draft SLR guidance and subsequent comments on these draft documents.

The staff took into consideration the comments received as a result of the formal solicitation described above and incorporated its dispositions into the July 2017 versions of the SLR guidance documents. This report provides the evaluation and disposition of public comments received by the NRC on the draft revisions of the SLR guidance.

Technical Bases Overview

The associated report, "Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192," NUREG–2221, provides a summary of changes and a synopsis of the bases for these changes made as part of the development of the SRP-SLR and the GALL-SLR Report. These changes include those that were initiated by NRC staff as well as the changes made in response to public comments, as appropriate. This document provides the underlying rationale that the NRC used in developing the SLR guidance.

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ABBREVIATIONS

AAC	all aluminum conductor
ACI	American Concrete Institute
ADAMS	Agencywide Documents Access and Management System
AERM	aging effect requiring management
A/LAI	applicant / licensee action item
AMPs	aging management programs
AMR	aging management review
ANSI	American National Standards Institute
ASM	American Society for Metals
ASME	American Society of Mechanical Engineers
ASME Code	American Society of Mechanical Engineers Boiler and Pressure Vessel Code
ASTM	ASTM International
AUX	auxiliary
B&PV	boiler and pressure vessel
B&W	Babcock & Wilcox
BAC	boric acid corrosion
BWR	boiling water reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CASS	cast austenitic stainless steel
CFR	*Code of Federal Regulations*
CLB	current licensing basis
CRD	control rod drive
CUF	cumulative usage factor
DLR	Division of License Renewal
EFPY	effective full-power year
EPRI	Electric Power Research Institute
EQ	environmental qualification
ESF	emergency safety feature
FAC	flow-accelerated corrosion
FE	further evaluation
FR	*Federal Register*
FRN	*Federal Register Notice*
FSAR	Final Safety Analysis Report
FWST	fire water storage tanks

GALL	Generic Aging Lessons Learned
GALL-SLR	Generic Aging Lessons Learned for Subsequent License Renewal
GL	generic letter
GSI	generic safety issue
HDPE	high density polyethylene
HPSI	high-pressure safety injection
HVAC	heating, ventilation, and air conditioning
I&E	inspection and evaluation
IASCC	irradiation-assisted stress corrosion cracking
IGSCC	intergranular stress corrosion cracking
ILRT	integrated leak rate test
IN	Information Notice
ISGs	Interim staff guidance
ISI	inservice inspection
ISP	integrated surveillance program
ksi	kilo pounds per square inch
LERs	licensee event reports
LCOs	limiting conditions for operation
LR-ISG	license renewal interim staff guidance
LRAs	license renewal applications
LTOP	low temperature overpressure protection
M&TE	measuring and test equipment
MEAP	Material-environment-aging effect-program combination
MEB	metal enclosed bus
MIC	microbiologically influenced corrosion
MPa	megapascal
mpy	mils per year
NACE	National Association of Corrosion Engineers
NDE	Non-destructive examination
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
NSSS	nuclear steam supply system

OCCW	open-cycle cooling water
OE	operating experience
P-T	pressure-temperature
PDI	performance demonstration initiative
PLL	Predicted lower limit
PoF	probability of failure
PTLRs	pressure-temperature limit reports
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
RAIs	request for additional information
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RG	Regulatory Guide
RIS	Regulatory Issue Summary
RPV	reactor pressure vessel
RVI	reactor vessel internal
RWCU	reactor water cleanup
RWT	refueling water tank
SCs	structures and components
SCC	stress corrosion cracking
SG	steam generator
SLR	subsequent license renewal
SLRAs	subsequent license renewal applications
SPC	steam and power conversion
SRP	standard review plan
SRP-SLR	Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants
SS	stainless steel
SSCs	systems, structures, and components
TLAA	time-limited aging analysis
TRs	technical or topical reports
TS	technical specifications
TSTF	technical specification task force

UFSAR	updated final safety analysis report
UHS	ultimate heat sink
US	United States
USACE	U.S. Army Corps of Engineers
USAR	updated safety analysis report
USE	upper-shelf energy
UT	ultrasonic testing
UV	ultraviolet

1 INTRODUCTION

This document is a knowledge management and knowledge transfer document associated with NUREG–2191, “Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report,” and NUREG–2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants” (SRP-SLR).

NUREG–2222, “Disposition of Public Comments on the Draft Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192,” contains the U.S. Nuclear Regulatory Commission (NRC) staff’s analysis of the public comments received on the drafts of NUREG–2191 and NUREG–2192. Public comment drafts of the GALL-SLR Report and the SRP-SLR were published on December 15, 2015, with the public comment period expiring on February 29, 2016. A supplement to the draft subsequent license renewal (SLR) guidance documents was published on March 29, 2016, with the public comment period expiring on May 31, 2016. The disposition of comments that were agreed with by the NRC staff and used as the basis for instituting a change to either the GALL-SLR Report or the SRP-SLR are detailed in this document. In addition, the public comments that did not result in a change to either NUREG are also dispositioned, and the staff’s technical basis for not agreeing with these comments is presented. Many public comments resulted in changes to the GALL-SLR Report and the SRP-SLR. Some of the changes to the SRP-SLR were derived from the changes to the GALL-SLR Report.

1.1 Purpose and Organization of the Document

NUREG–2222 contains the NRC staff’s analysis of the public comments received on the drafts of NUREG–2191 and NUREG–2192.

This document is organized into two sections. Section 1 contains background and overview information. Section 2 summarizes the analysis and disposition of all public comments received on the draft of the GALL-SLR Report and the SRP-SLR during the public comment period. Section 2 is further subdivided by the comments provided by each comment submitter and identified by the source number assigned to each comment submitter as the comment documents were entered into the Technical Comments Database used to track and disposition all comment documents received on the Regulations.gov Docket NRC-2015-0251. Table 1-1 provides the reader a summary and crosswalk to all of the public comments submitted and dispositioned in this document. All comments were entered into the Technical Comments Database in the order they were found in each source comment document.

Table 1-1 Crosswalk of Public Comment Sources and Reference Identification Numbers

Comment Submitter	Subject	ADAMS Accession Number	Regulations.gov Docket Number	Technical Comments Database Source Number
Anonymous	Aging Management Program (AMP) X.E1	ML16015A326	NRC-2015-0251-0005	009
Jan Boudart	Palisades Nuclear Power Plant	ML16015A327	NRC-2015-0251-0006	010
Anonymous	AMP XI.M31	ML16035A273	NRC-2015-0251-0007	011
Eric Jones	AMP X.M2	ML16035A274	NRC-2015-0251-0008	012
Anonymous	NUREG–2192 Section 4.2	ML16049A580	NRC-2015-0251-0009	013
Nuclear Energy Institute (NEI)	Industry Feedback on Changes to GALL-SLR (Draft NUREG–2191) and SRP-SLR (Draft NUREG–2192) (Provided as 7 attachments)	ML16069A068	NRC-2015-0251-0019	
	Attachment 1—NUREG–2191 Significant Issues—Summary List			014
	Attachment 2—Mechanical Comments (non-AMP)			015
	Attachment 3—Mechanical AMPs X.M1–XI.M22			016
	Attachment 4—Mechanical AMPs XI.M23–XI.M42			017
	Attachment 5—Mechanical AMP XI.M31			018
	Attachment 6—Structural Comments			019
	Attachment 7—Electrical Comments			020
Andrew Prinaris	Structural AMPs	ML16068A056	NRC-2015-0251-0017	021
Electric Power Research Institute (EPRI)	AMPs XI.M7, XI.M9, XI.M11B, XI.M16A, XI.M31, XI.E1, XI.E2, XI.E3A, XI.E3B, XI.E3C	ML16067A382	NRC-2015-0251-0013	025
Paul Frey	Diablo Canyon PowerPoint Presentation	ML16068A029	NRC-2015-0251-0014	030
Wallace Taylor	General Comment	ML16068A067	NRC-2015-0251-0016	031
Michel Lee	General Comment	ML16068A070	NRC-2015-0251-0018	032
Wolf Creek Nuclear Operating Corporation	AMPs X.M1, XI.M1, XI.M3, XI.M11B, XI.M12, XI.M16A, XI.M17, XI.M18, XI.M42, XI.S1, XI.S3, XI.S5, XI.S6, XI.S7, XI.E6	ML16068A049	NRC-2015-0251-0015	033
Donna Gilmore	General Comment	ML16063A105	NRC-2015-0251-0010	034
Meghan Belaski	General Comment	ML16063A107	NRC-2015-0251-0011	035
Marvin Lewis	General Comment	ML16063A108	NRC-2015-0251-0012	036
NEI	AMPs XI.M30, XI.M32, XI.M39	ML16082A277	NRC-2015-0251-0023	040
NEI	Comments on the Supplemental Guidance to Draft NUREG–2191 and Draft NUREG–2192	ML16153A236	NRC-2015-0251-0024	045

2 ANALYSIS AND DISPOSITION OF PUBLIC COMMENTS ON THE DECEMBER 2015 PUBLIC COMMENT DRAFT GUIDANCE DOCUMENTS FOR SUBSEQUENT LICENSE RENEWAL

2.1 Public Comment Solicitation and Management

The U.S. Nuclear Regulatory Commission (NRC) issued draft subsequent license renewal (SLR) guidance documents, NUREG–2191, Vol. 1 and Vol. 2, [Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report] and NUREG–2192 [Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR)] on December 15 and 16, 2015, for public comment. The *Federal Register* (80 FR 79956) pages 79956–79958, published on December 23, 2010, began a 68-day public comment period. In addition, the NRC published a supplement to NUREG–2191 and NUREG–2192 on March 29, 2016 (81 FR 17500) for a 60-day comment period to provide supplemental guidance to applicants and NRC staff on changes that were not developed in time for the publication of draft NUREG–2191 and NUREG–2192.

Following the publication of these draft documents, the NRC staff conducted a public meeting on January 21, 2016, and February 22, 2016, at its Rockville, Maryland headquarters to initiate a dialogue with the public and to introduce them to some of the significant changes between the guidance documents for SLR and first license renewal. The purpose of the public meetings was to provide:

- an opportunity for the staff to inform the public about the draft GALL-SLR Report and SRP-SLR NUREGs
- an opportunity for an exchange of information about the draft NUREGs
- an opportunity for stakeholders to ask questions about the draft NUREGs
- a forum for stakeholders to provide informal feedback on the drafts

The staff was particularly interested in comments that addressed the safety review, effectiveness, and efficiency of the future SLR process. Formal comments on the draft NUREGs and their supplement were to be provided through means identified in the *Federal Register* (e.g., written letter and submittal to Regulations.gov). Comments during the public meetings were not accepted as formal comments. The staff anticipated that some topics would not be discussed fully due to time limitations. The staff also conducted focused public meetings following the close of the comment period for in-depth technical discussions of the aging management programs (AMPs) and further evaluation items that were identified as being more significant by public commenters.

All public comments were put into a Technical Comments Database developed specifically for the purpose of managing and dispositioning public comments. The comments were binned according to the expert panel that would be addressing those comments. The database allowed the input of the comments, identification of the commenter and their affiliation, agreement or disagreement of comment's recommended actions, and the technical basis of each decision. Each comment in the database received a unique comment number related to source of the comment and its place in the document and chapter/subchapter or aging management review item to which it applied. This unique number can be used to identify and track comments, their disposition, and the resulting changes throughout this guidance document in the appropriate tables. Over 300 pages of public comments were received on the SRP-SLR and GALL-SLR Report. For a number of public comments, the NRC staff took the liberty to clarify and/or paraphrase the comment. Those comments are denoted with a "[…]" around the text, which the staff clarified and/or paraphrased.

2.2 Disposition of Public Comments on the December 2015 Draft GALL-SLR Report, SRP-SLR, and the March 2016 Draft Supplement

All of the public comments on the December 2015 public comment Draft GALL-SLR Report, Draft SRP-SLR, and on the March 2016 draft supplement that were received as a result of the public comment period are presented in the pages that follow. The comments are organized by comment submitter (Source number) and presented in the order they appeared in the comment document. Each comment has a unique comment number. The comment, along with any rationale or justification provided by the commenter, is presented verbatim when possible. Comments that referred to other documents that were too large to capture in the Technical Comments Database are noted as such. The disposition of each comment is provided, particularly whether the comment was agreed with by NRC staff and resulted in a change to the draft GALL-SLR Report, or whether the comment was disagreed with and did not cause any changes to the draft GALL-SLR Report. Finally, the technical basis for each comment disposition is provided, explaining either why the comment was disagreed with, or why the changes prompted by the comments were implemented.

DRAFT NUREG–2191 AND NUREG–2192

PUBLIC COMMENTS AND RESPONSES

Source 009: Anonymous—AMP X.E1

Comment: 001

I am sending several comments on the section X.E 1 “Environmental Qualification of Electric Components” of NUREG–2191, Vol.2, as attached.

Comment No. 1

The 8th line of pp.X.E1-1

Bracket “)” is missing between “environment” and “are”.

RESPONSE:

The staff agreed with the comment and associated changes were made to the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report. No technical basis is required to incorporate this change (typographical error) as it is editorial in nature.

Comment: 002

I am sending several comments on the section X.E 1; “Environmental Qualification of Electric Components” of NUREG–2191, Vol.2, as attached.

Comment No.2

The 33th line of pp .X.E1-8

As for the reference of JNES-SS-0903, the correct name of the organization that issued the document is “Japan Nuclear Energy Safety Organization” (not “Japan Nuclear Safety Organization”), and abbreviated name is “JNES” (not “JNSO”)

RESPONSE:

The staff agreed with the comment and the associated changes were made to the GALL-SLR Report. The staff removed the reference to this report because although it contains good information, the report has not undergone official review by the U.S. Nuclear Regulatory Commission (NRC).

Comment: 003

I am sending several comments on the section X.E 1 “Environmental Qualification of Electric Components” of NUREG–2191, Vol. 2, as attached.

Comment No.3

The 25th line of pp.X.E1-9

The correct abbreviated name of “Organisation for Economic Co-operation and Development” in English is “OECD” (not “OCDE”).

Source 009

RESPONSE:

The staff agreed with the comment and the associated changes were made to the GALL-SLR Report. The staff removed the reference to this report because although it contains good information, the report has not undergone official review by the NRC.

Comment: 004

I am sending several comments on the section X.E 1 “Environmental Qualification of Electric Components” of NUREG–2191, Vol.2, as attached.

Comment No.4

In this revision, Ongoing Qualification was newly added as a measure to establish the qualification of equipment for the period of 60-80 years.

However, it is not clear if “ongoing qualification” methodology is a part of “reanalysis” or not.

For instance,

In the 2nd line of pp.X.E1-2, it says “reanalysis or ongoing qualification”. This means “reanalysis” and “ongoing qualification” are different methodologies.

However, in the 23th line of pp. X.E1-5, “Ongoing Qualification” is listed one of the reanalysis attribute under Environmental Qualification Equipment Reanalysis Attribute section, namely, “ongoing qualification” seems to be a part of “reanalysis.”

Although “ongoing qualification” is listed one of the attributes like above, in the 25th line of pp.X.E1-5, a phrase “As an alternative to reanalysis” seems to mean that “ongoing qualification” is not a part of “reanalysis”

In light of this issue, other parts of this document need to be considered. For instance, in the 25-30th lines of pp X.E1-2, attributes of reanalysis is introduced. However, ongoing qualification is not included in these sentences.

In addition, in the 39–44th of ppX.El-2 and 1–3 lines of X.E1-3, regulatory position and relation with 1O CFR 54.21(c)(1)(iii) are stated only for “reanalysis”. Regulatory position on “ongoing qualification” is unclear.

RESPONSE:

The staff agreed with this comment and associated changes were made to the GALL-SLR Report. An additional section was added on page X.E1-2 to define what is meant by “reanalysis” and on page X.E1-5 to define what is meant by “ongoing qualification.” Reanalysis requires looking at the original attributes, assumptions and conservatisms for environmental conditions, and other factors of an aging evaluation to demonstrate that the equipment’s qualified life can be extended. Ongoing qualification, for the purposes of this document is defined as the process of requalifying a component through activities similar to the original qualification, which may include testing, type testing, or a monitoring program. The revisions clarify the relationship of term reanalysis to the term ongoing qualification, and provides consistent terminology to that used in Regulatory Guide (RG) 1.211 and Institute of Electrical and Electronics Engineers (IEEE) Standard 383-2003.

Source 010: Jan Boudart—Palisades Nuclear Power Plant

Comment: 001

2016-01-07: Docket 2015-0251

This comment regards radiation danger to Lake Michigan, the people of Chicago and the State of Illinois, especially in reference to the Palisades Nuclear Power Plant in Covert Township, Van Buren County, Michigan. The Palisades NPP achieved its projected lifespan in 2011. Three or four years before that the NRC changed its rules to allow an extension of 20 years—so that Palisades is now scheduled to continue operations until 2031, at which time it will be 60 years old.

Palisades is recognized by the NRC itself as being a plant very susceptible to embrittlement of its steel reactor vessel. But with another relaxation of old rules in favor of new, a coupon sample of its metal has been postponed to 2019. The previous test of the reactor vessel metal, itself, occurred in 2003. This 16-year span glides through the originally proposed 2011 closing of Palisades.

However, the NRC has allowed a mathematical formula to supersede actual physical testing of the reactor metal. The formula is based on results from, other NPPs and is obscure in its results. It creates a distance between what the NRC perceives and what activists and the public perceive.

In addition, results from one capsule test, Number A-60 from 1984 has disappeared along with any data it may have revealed.

Both of these problems with testing the reactor metal feel very much like pussyfooting around the truth.

But Palisades is just one example, even if the most flagrant, of the NRC changing horses in midstream to obfuscate results and obscure understanding of how they reach conclusions. The concept of public responsibility is the real loss in these situations where the NRC plays loosely with public safety.

RESPONSE:

The staff did not agree with this comment. Regarding the commenter's concerns about the license renewal of Palisades Nuclear Generating Station allowing a licensed life of up to 60 years, the Atomic Energy Act (AEA) of 1954, as amended, authorizes the U.S. Nuclear Regulatory Commission (NRC) to issue 40-year initial licenses and, upon application and approval, subsequently renew licenses for nuclear power reactors. The NRC regulations permit these licenses to be renewed beyond the initial 40-year term for an additional period of time, limited to 20-year increments per renewal, based on the outcome of an assessment to determine if the nuclear facility can continue to operate safely during the proposed period of extended operation. The initial license renewal for Palisades Nuclear Generating Station was completed in October 2006 (see NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants," Supplement 27).

The commenter's specific concerns regarding Palisades Nuclear Generating Station (e.g., local protection of human health and the environment, embrittlement in the reactor vessel, and use of models rather than physical samples to determine safety of the plant) would be addressed as part of an individual plant's license renewal application review process. The scope of the Generic

Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report and Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) is to: (i) describe methods acceptable to the NRC staff for granting a subsequent license renewal (SLR) (e.g., a renewal beyond the initial 60-years) in accordance with license renewal regulations, and (ii) describe the techniques used by the NRC staff in evaluating applications for SLR. The commenter's concerns are therefore beyond the scope of these documents.

The commenter also noted that the NRC's actions are not transparent to the public. The NRC strives to conduct its activities in an open and transparent manner and inform the public about regulatory processes. In many cases, such as development of these documents and for license renewals, the NRC provides draft documents to the public for comment and hold public meetings to gather input and respond to concerns. After carefully evaluating the public comments and making resulting changes, as appropriate, the NRC prepares and publishes the final documents, which address the public comments.

Source 011: Anonymous—AMP XI.M31

Comment: 006

Regarding Section XI.M31, the Program Description and portions of the Evaluation and Technical basis make the assumption that surveillance capsules, such as those installed in the BWR and PWR fleet operating in the US, have a fluence that “leads” the peak pressure vessel fluence. However, recent surveillance testing has shown that certain designs have capsules which “lag” the peak vessel location, that is, they have a fluence which is lower than that of the peak vessel location at any given time. Due to this, it is impossible for such plants to use their existing surveillance capsule specimens to evaluate future conditions of the pressure vessel embrittlement and specifically preclude the condition of achieving a “fluence of between 1.0 and 1.25 times the peak reactor vessel wall neutron fluence projected at the end of the subsequent period of extended operation.”

Specific examples of plants that are unable to meet this requirement include BWR/6 designs whose capsules are installed at 3/177/183 degrees along the flat sides of the reactor core where the core to vessel distance is greatest and, therefore, has the lowest fluence. It has also been shown for BWR/4 and BWR/5 designs that the capsule may also lag despite being mounted in a location much closer to the vessel peak fluence azimuth.

For further evidence, see BWRVIP-250NP (NRC Accession Number ML11326A290) and BWRVIP-281NP (NRC Accession Number ML14308A077).

RESPONSE:

The staff reviewed this comment. No changes were made to the aging management program (AMP) because the comment did not propose any specific changes. The staff concluded that the target neutron fluence range in the AMP represents the guidance for one approach to an adequate reactor vessel material surveillance program. If subsequent license renewal (SLR) applicants are unable to satisfy the staff's guidance due to, for example, plant configuration attributes, they will justify the adequacy of their proposed program in their application and the proposed program will be evaluated on a plant-specific basis.

Source 012: Eric Jones—AMP X.M2

Comment: 007

GENERAL COMMENT:

The following comment is made regarding Section X.M2:

Pg X.M2-3: The term "active field region" is used in two places without being defined. This term is not commonly used in the regulatory framework. For example, it does not appear at all in NRC RG 1.190. If this term is meant to refer to the active fuel region, consider changing it thusly, or consider using a term more in line with NRC RG 1.190, such as "core beltline region".

RESPONSE:

The staff agreed with this comment and associated changes to the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report have been made. The phrase "active field region" will be replaced with the phrase "active fuel region." No technical basis is required to incorporate this change as it is editorial in nature.

Source 013: Anonymous—NUREG–2192, Section 4.2

Comment: 001

Draft report states:

With regards to sections 4.2.2.1.3 (page 4.2-3), 4.2.1.1.5 (page 4.2.5), 4.2.1.1.6 (page 4.2-6), 4.2.3.1.5 (page 4.2-13) and 4.2.3.1.6 (page 4.2-13) the draft standard review plan for subsequent License renewal (NUREG–2192) cites phrases "*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)"*

Action (1):

This sentence highlighted in italics appearing in the cited sections in Standard Review plan—Subsequent License renewal (SLR) (NUREG–2192, Docket ID: NRC-2015-0251) needs to be removed or rephrased to give the guidance some clarity and unambiguity.

COMMENT:

This carries from the original Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR) (NUREG–1800) published in 2001. Specifically, in dispositioning licensee's renewal applications the staff generally accept applicant's plant-specific analysis for TLAAs based on real-time fluence data from capsules removed from reactor and dosimetry measurements projected through effective full power years to satisfy licensing bases for the renewal periods or using EMAs and accepting other justification as to how they satisfy requirements of 10 CFR 10 CFR 54.21(c) (1)(i) thru (iii). This is a standard routine and a universally accepted procedure. So, this being the current status of these reviews, unless staff have a specific reason, have other legal objections, or actually working on alternatives, it is suggested that it is time to remove the phrase from the SRP. The SRP is the agency's guidance to applicants, and as such should not appear ambiguous as implied by phrase "Approved technical alternatives for SLR have yet to be developed."

RESPONSE:

The staff did not agree with this comment or the changes to Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR), Chapter 4.2 subsections, as referenced in the comment and based on the arguments in the comment. No changes were made to SRP-SLR Chapter 4.2 or its subsections based on this comment.

The comment relates to mean adjusted nil ductility reference temperature calculation (i.e., mean RT_{NDT} calculations) that are part of probability of failure (PoF) analyses for boiling water reactor (BWR) reactor pressure vessel (RPV) axial and circumferential welds. These types of analyses are used in support of relief requests that are submitted in accordance for Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z) and are used to request elimination of American Society of Mechanical Engineers (ASME) inservice inspection requirements and the augmented inspection requirements in 10 CFR 50.55a for performance of volumetric examinations of circumferential welds in BWR-designed reactor vessels. The proprietary methods for performing these analyses are given in Electric Power Research Institute (EPRI) Proprietary Report No. TR-105697 (i.e., BWRVIP-05, September 1995); however, the PoF and mean RT_{NDT} calculations in Boiling Water Reactor Vessel and Internals Project (BWRVIP)-05 have yet to be updated for

80-year bases, as assessed for full power capacity factors in excess of 80 percent (which is now common for the industry). As always, licensed owners of BWR facilities desiring to apply for BWRVIP-05 reliefs of their RPV circumferential welds during a subsequent renewal period will be required under 10 CFR 50.55a(z) to re-apply for approval of the relief requests, such that the relief requests would need to be submitted and approved prior to entry into the first ISI interval of the subsequent renewal period. PoF analyses and mean RT_{NDT} analyses for the axial welds will be needed for such reliefs. Therefore, the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report appropriately calls for these types of analyses to be dispositioned under the criterion in 10 CFR 54.21(c)(1)(iii) and indicates that applicants having these types of time-limited aging analysis (TLAAs) will need to address them on a case-by-case basis. The intent is that the regulatory process for submitting the applicable relief request for the circumferential welds under 10 CFR 50.55a(z)(1) will serve as an acceptable basis for accepting these types of TLAAs under the criterion in 10 CFR 54.21(c)(1)(iii). Therefore, no changes need to be made to the acceptance criteria guidelines in SRP-SLR, Sections 4.2.2.1.5 and 4.2.2.1.6, for performing these types of analyses, or the corresponding review procedure guidelines in SRP-SLR, Sections 4.2.3.1.5 and 4.2.3.1.6.

Comment: 002

Action (2):

It is suggested that agency initiate action to make an exception to the provisions of the Administrative Procedures Act, Section 558 under 10 CFR 54 especially for Subsequent License Renewal (SLR) applicants. We understand that this being an act of congress, it cannot be rescinded except by another act of Congress; but, allowing a plant operator however, to continue to operate under the provisions of timeliness, when the staff review and other process gets protracted beyond the normal limit of 5 years to accord approval (example Indian Point). It is not in the best interest of public safety for reason explained below. In the alternative, pending a formal renewal accord for the SLR period, add a license condition(s) to require licensees entering "timely renewal" period past 5 years after application submission under 10 CFR 2.109, "Effect of Timely Renewal Application," such that licensee had implemented upfront, all aging-management activities, TLAA provisions and other agreements reached and as documented in the safety evaluation reports with staff, into plant's Updated Final Safety Analysis Report (UFSAR). And that the plant technical specification reflects these changes as appropriate. This of course, if the licensee wishes to operate the plant(s) on or after the expiration of its current license term and plan to enter into the provisions of timeliness rule time domain.

COMMENT:

The timeliness rule under the current provisions of the Administrative Procedures Act, Section 558 allows "when the licensee has made timely and sufficient application for a renewal or a new license in accordance with agency rules, a license with reference to an activity of a continuing nature does not expire until the application has been finally determined by the agency." At the same time aging management activities necessary for the period of extended operation (60 plus years) are required to be implemented only after a power reactor license is renewed. Therefore, these provisions can result in a situation in which a licensee may" enter the period of extended operation without a renewed license and without having implemented aging-management activities as discussed in the license renewal application and as relied on by the staff during review of the application. Especially when the units are past their 60-years of operations, the passive components are much more vulnerable to catastrophic failures and operating in undetermined safety conditions. Thus, continued operations may place public safety in some jeopardy. The agency is well advised to consider seeking exemption to remove the provisions of this act that allows a blanket guarantee to continued operation without imposing conditions that aging management provisions are implemented prior to-entering the SLR period. Leaving it as a license commitment to be implemented is not acceptable. Much less, leaving this responsibility to regional inspection staff, without appropriate resources to complete the verification on a complex subject such as this is not prudent.

RESPONSE:

The Commission's regulation in 10 CFR 2.109, "Effect of Timely Renewal Application," implements the "timely renewal" provision of Section 9(b) of the Administrative Procedure Act (APA), Title 5, "Government Organization and Employees," of the United States Code (U.S.C.) Section 558(c). Under this regulation, if a licensee requests a renewed license at least 5 years before expiration of its current license, the request is considered "timely," and the facility is allowed to continue to operate under its existing license until the U.S. Nuclear Regulatory Commission (NRC) completes its review and reaches a decision on the license renewal request.

The NRC keeps Congress fully and currently informed of the agency's regulatory activities. The NRC's Office of Congressional Affairs is the main conduit for NRC communications with Congress. Through the Atomic Energy Act (AEA), Congress has mandated that the NRC establish criteria to allow the licensing of nuclear power plants. Unless a threat to the public health and safety or the common defense and security exists, the NRC has no authority to deprive current licensees of their vested interest in licenses already issued in compliance with those regulatory standards.

NRC staff did not agree that the APA or 10 CFR 2.109 should be revised. Existing regulations allow licensees to continue to operate under existing licenses, with certain modifications to procedures and safety analyses to assure continued safe operation during the timely renewal period.

Source 014: NEI Attachment 1—NUREG–2191 Significant Issues Summary List

Comment: 001

A plant-specific program is required for PWR Vessel Internals. MRP-227 should be used as a starting point for aging management in the GALL-SLR AMP and associated AMRs. (XI.M16A)

RESPONSE:

The staff partially agreed with the comment. In the draft Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report and Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) reports, the staff deleted GALL-SLR Report AMP XI.M16A, “PWR Vessel Internals,” from the scope of the guidelines and instead developed new further evaluation criteria in Section 3.1.2.2.9 of the SRP-SLR that provided criteria for subsequent license renewal applicants of pressurized water reactor (PWR) facilities to develop plant-specific aging management programs (AMPs) for their reactor vessel internals (RVI) components.

The staff received a total of five similar comments from the Nuclear Energy Institute (NEI), Electric Power Research Institute (EPRI), or members of the industry on these changes. Specifically, the industry recommended that a version of AMP XI.M16A in the NRC Interim Staff Guidance (ISG) Document No. LR-ISG-2011-04, “Updated Aging Management Criteria for Reactor Vessel Internal Components of Pressurized Water Reactors,” be reinserted into the GALL-SLR Report, and that the corresponding aging management review (AMR) items for PWR RVI components in LR-ISG-2011-04 be reinserted into the GALL-SLR Report, Tables IV.B2, IV.B3, and IV.B4, and into SRP-SLR, Table 3.1-1. The industry members made the point that the sampling-based condition monitoring program in EPRI Report No. 1022863 Materials Reliability Program (MRP)-227-A could serve as the starting point for the AMP that would be used to manage aging in PWR RVI components during a subsequent period of extended operation.

The staff agreed with NEI and members of the United States (U.S.) nuclear power industry that AMPs for PWR RVI components are living programs; however, the staff maintained its position in the draft versions of the GALL-SLR Report and the SRP-SLR that the assessment of PWR RVI components over an 80-year period could potentially change the inspection criteria in the MRP-227-A report for some components. Therefore, the staff informed members of the industry that, if MRP-227-A is retained as the starting basis for an applicant’s RVI management program (e.g., PWR Vessels Internals Program), further evaluation of the inspection and evaluation (I&E) protocols in the MRP-227-A report would need to be performed in order to assess whether potential changes to the I&E protocols in the report would need to be made if the RVI components at the facility were assessed for aging effects or mechanisms over a cumulative 80-year licensed operating term.

As a result of these statements to NEI, the staff updated the further evaluation acceptance criteria in SRP-SLR Section 3.1.2.2.9 and review procedures in Section 3.1.3.2.9 to provide a PWR applicant with the option of using MRP-227-A as the starting point for its AMP, but as subject to a gap analysis that would be used to identify potential changes to the I&E protocols in MRP-227-A if the aging assessment of the RVI components at the plant were performed on an 80-year basis. Alternatively, these SRP-SLR sections continue to allow a PWR applicant to choose the option of developing a plant-specific aging management program for its RVI components.

In addition, the staff restored a modified version of AMP XI.M16A into Chapter XI of the GALL-SLR Report. The amended version of the AMP provides additional criteria for the types of considerations a PWR subsequent license renewal (SLR) applicant would need to consider when performing a gap analysis of its PWR RVI components. The staff incorporated its minimum expectations and criteria for performing the gap analysis into the programmatic elements in GALL-SLR AMP XI.M16A.

The staff also restored AMR items for Westinghouse-designed, Combustion Engineer (CE)-designed, and Babcock & Wilcox (B&W)-designed PWR RVI components in LR-ISG-2011-04 into SRP-SLR Table 3.1-1, and GALL-SLR Report Tables IV.B2, IV.B3, and IV.B4, but modified the AMR items to indicate that the components in the AMR items will be subject to the further evaluation guideline criteria in SRP-SLR Section 3.1.2.2.9 and the review procedures in SRP-SLR Section 3.1.3.2.9. Thus, the “Further Evaluation” column entries for these AMR items have been amended to state “Yes” for further evaluation. However, since the staff retained an alternate plant-specific aging management basis for PWR internals in SRP-SLR Section 3.1.2.2.9, the staff decided to retain AMR items IV.B2.R-423, IV.B2.R-424, IV.B3.R-423, IV.B3.R-424, IV.B4.R-423, and IV.B4.R-424 in the Tables IV.B2, IV.B3, and IV.B4 of GALL-SLR Report and items 3.1.1-18 and 3.1.1-19 in Table 3.1-1 of the SRP-SLR.

Analogous comments received on this matter were submitted from Sources 015 (Comment 001), 016 (Comment 054), 025 (Comment 007), and 033 (Comment 009). This basis forms the staff’s basis for resolving the analogous comments from Sources 015, 016, 025, and 033.

Comment: 002

Reactor vessel internals fluence monitoring is not required. MRP-227 and BWRVIP have analyzed bounding fluence thresholds for selected degradation mechanisms that will be re-evaluated as part of the industry programs. (X.M2)

RESPONSE:

The staff partially agreed with this comment. Similar comments were made from several sources. Collectively, these comments imply the industry’s perspective that the scope of GALL-SLR Report AMP X.M2, “Neutron Fluence Monitoring,” should not include neutron fluence monitoring criteria for areas of the reactor pressure vessel (RPV) outside of the beltline region of the RPV or for boiling water reactor (BWR) or PWR RVI components. The staff agreed with some of the bases for making these comments, but did not accept the industry’s position to remove references of RPV non-beltline components or RVI components, or the monitoring criteria for these components, from the scope of the AMP.

The staff agreed that the scope and design of 10 CFR 50, Appendix H, RPV surveillance programs have been optimized to monitor the fluence exposures of ferritic base metal and weld materials that are representation of those that are located in the beltline region of the RPV, and not those for RPV non-beltline components or RVI components. However, the regulation in 10 CFR Part 50, Appendix G, Fracture Toughness Requirements, and for PWRs, the requirements in 10 CFR 50.61 requires applicants to evaluate the impacts that increasing fluence exposures will have on the fracture toughness evaluations of RPV beltline base metal and weld components that are made from ferritic steel materials. The staff uses the fluence threshold mention in 10 CFR Part 50, Part Appendix H (i.e., a fluence of 1×10^{17} n/cm^2 for neutrons with energies greater than 1.0 MeV) as its basis for establishing the bounds of the beltline region of the RPV. As a result, the fluence exposures accumulated during a proposed subsequent period of extended operation could potentially increase the number of ferritic RPV components that need to be defined as constituting the beltline region of the RPV in a proposed subsequent license renewal application (SLRA). As a result, the staff has included monitoring criteria in AMP X.M2 for RPV non-beltline components in order to provide one method that may be used to determine and establish the scope of RPV beltline components that need to be included in a given RPV neutron embrittlement time-limited aging analysis (TLAA), as applied to and implemented during a proposed subsequent period of extended operation.

In relation to providing criteria for monitoring of neutron fluence for RVI components, the existing models and fluence calculations for the reactor vessel components may include some modeling of RVI components to account for attenuation of the neutrons through the RVI components. However, the staff acknowledges that the application of the fluence methodologies to the RVI components has not generally been generated and documented/reported in the reactor vessel surveillance capsule reports that are required to be submitted in accordance with the 10 CFR Part 50, Appendix H reporting requirements.

The staff also acknowledges that industry organizations, such as the Electric Power Research Institute (EPRI) MRP or EPRI Boiling Water Reactor Vessel and Internals Project (BWRVIP), may have used what they consider to be bounding thresholds for neutron fluence-related aging effects when developing their augmented inspection guideline criteria for RVI components in specific technical reports (TRs) issued by the organizations. However, the establishment of these thresholds does not necessarily guarantee that the fluence levels for the RVI components at an applicant's facility will be within the neutron fluence values assumed and set for the components in the applicable TRs. For past RVI AMPs that may have relied on these types of TR guidelines (i.e., GALL-SLR AMP XI.M16A, "PWR Vessel Internals," or GALL-SLR AMP XI.M9, "BWR Vessel Internals"), the past applicants may have submitted and relied on applicant/licensee action item response, standard review plan (SRP) further evaluation response, or request for additional information (RAI) response information in order to achieve the following aging management objectives in the license renewal applications (LRAs): (a) demonstration that the fluence levels for RVI components at their facilities are sufficiently bounded by those assumed and established in the relevant TRs, and (b) demonstration that the plant-specific neutron fluence methodology being applied to the components represents a sufficiently conservative basis for projecting the neutron fluences of these components to the end of the period of extended operation. In these instances, the applicants may have submitted or described the transport calculations for these components on an application-specific or plant-specific basis, and the NRC staff evaluated the RVI fluence methods or evaluations on a case-by-case basis. Thus, the staff also finds that it is appropriate to include neutron fluence monitoring guidance and criteria for RVI components in the scope of AMP X.M2.

Comment: 003

Program scope of BWR Stress Corrosion Cracking Program revised the RCS temperature to 140 degrees which is no longer consistent with GL 88-01. (XI.M7)

RESPONSE:

The staff agreed with the comment. This was an editorial error in the draft GALL-SLR Report. The scope of the program was revised to "all BWR piping and piping welds made of austenitic–SS and nickel alloy that are 4 inches or larger in nominal diameter containing reactor coolant at a temperature above 93 degrees C (Celsius) [200 degrees F (Fahrenheit)] during power operation, regardless of code classification."

Comment: 004

A baseline inspection of bottom mounted instrument nozzles using a qualified volumetric examination method is required. The existing program of regular visual exams is sufficient. (XI.M11A)

RESPONSE:

The staff agreed with this comment.

The baseline examination provision for bottom-mounted instrumentation (BMI) nozzles is deleted. The comment disposition is based on the following factors.

The existing visual examination specified in 10 CFR 50.55a has been effective in managing the aging effect of primary water stress corrosion cracking (PWSCC) in BMI nozzles. The current operating experience does not indicate aging-related degradation requiring additional inspections.

Comment: 005

A baseline inspection using a qualified volumetric method or inner diameter surface inspection of all susceptible nickel alloy branch line connections and welds consistent with MRP-126 which is a 2004 document is required. The existing program of regular visual exams is sufficient. (XI.M11A)

RESPONSE:

The staff did not agree with this comment. The GALL-SLR Report has not been changed.

The staff noted that the recent operating experience, as discussed in Regulatory Issue Summary (RIS) 2015-10, indicates that applicants/licensees may have not examined branch line connections and associated welds using a volumetric method in contrast with the requirements specified in ASME Code Case N-770-1 as incorporated by reference in 10 CFR 50.55a. The staff's view is that the volumetric baseline inspection provision in GALL-SLR 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)," is necessary to confirm that PWSCC is not occurring in the branch line connection components given the possibility these components may have not been volumetrically examined for a relatively long period of time.

Generally speaking, the GALL-SLR Report may identify augmented inspection activities to ensure effective aging management in addition to the existing requirements of ASME Code Section XI and mandatory ASME Code Cases that have been incorporated by reference in 10 CFR 50.55a. Nonetheless, the staff does not view that the baseline inspection of branch line connection components as an augmented activity beyond the requirements in 10 CFR 50.55a, consistent with the clarification in RIS 2015-10 that ASME Code Case N-770-1 includes branch line connections in its scope. In addition, GALL-SLR AMP XI.M11B clearly indicates that existing periodic inspections (e.g., inservice inspection) may be credited for this baseline inspection.

<u>Comment</u>: <u>006</u>

Reactor vessel surveillance capsule fluence between 1 and 1.25 of the SLR peak fluence is required even though some plants have tested a capsule that has a higher [sic} fluence higher than 1.25 and no capsules remain. Consistent with existing requirements, capsule fluence between 1 and 2 of peak SLR fluence should be allowed. (XI.M31)

RESPONSE:

The staff agreed with this comment. The staff concluded that the recommended change to the AMP (in several places) modifies the fluence range to between one and two times the peak neutron fluence of interest, where the peak neutron fluence of interest should address the TLAAs applicable to the plant, as described in Section 4.2 of the SRP-SLR. The staff concluded that there is no substantial benefit to overly restrict the fluence range for the surveillance capsules, and thus has modified the range, as stated above.

<u>Comment</u>: <u>007</u>

SLR contingency reactor vessel surveillance capsules are required for plants that tested all capsules. (XI.M31)

RESPONSE:

The staff agreed with this comment. The recommended change to the AMP is to eliminate the paragraph that discusses the need for additional capsules to address contingencies.

The staff concluded that no guidance is needed on this topic, since the need for and availability of additional capsules is a plant-specific consideration that will be evaluated during the review of the SLRA.

<u>Comment</u>: <u>008</u>

Inspecting for surface discontinuities and imperfections, and clearances and physical displacement for signs of loose joints is overly prescriptive. Inspection for signs of leakage should be sufficient, especially for non-safety related bolting. (XI.M18)

RESPONSE:

The NRC staff agreed with this comment. The wording was deleted from GALL-SLR AMP XI.M18, “Bolting Integrity,” in regard to visual inspections of bolting.

The staff agreed with this comment because GALL-SLR AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” incorporates the inspection of ASME Class 1, Class 2, and Class 3 closure bolting where the use of a VT-1 inspection methodology is recommended. With the exception of volumetric inspection of high-strength closure bolting, AMP XI.M18 is based on visual inspections for signs of leakage at bolted connections. During inspections for leakage, it is not expected that indications of surface discontinuities and imperfections, and clearances and physical displacement would be within the scope of the inspection. However, the staff also addressed closure bolting that is submerged, where the piping systems contains air or gas for which leakage is difficult to detect, or closure bolting for components that are not normally pressurized. The Detection of Aging Effects program element provides specific recommendations for inspecting submerged closure bolting, closure bolting where the piping systems contains air or gas, and closure bolting for components that are not normally pressurized. Inspecting for signs of leakage might not always be appropriate for these closure bolts.

Comment: 009

When fouling is identified in Fire Water Systems, deposits are required to be removed regardless of flow test results or minimum wall exam results. In addition, Open Cycle Cooling Water System corrective actions require that fouling is also required to be removed. (XI.M27 and XI.M20)

RESPONSE:

The NRC staff agreed with this comment.

The recommendations in GALL-SLR AMP XI.M20, "Open-Cycle Cooling Water System," (Corrective Actions) and GALL-SLR AMP XI.M27, "Fire Water System," (Detection of Aging Effects) related to removal of deposits cited in the comment were deleted.

AMP XI.M20 and AMP XI.M27 include sufficient recommendations addressing fouling products detected inside components in lieu of recommending removal of deposits.

The Corrective Actions program element of AMP XI.M20 includes reevaluation, repair, or replacement of components that do not meet minimum wall thickness requirements and if fouling is identified, the overall effect is evaluated for reduction of heat transfer, flow blockage, and (if applicable) chemical treatment effectiveness. Fouling deposit removal is not required if evaluations can demonstrate that all adverse effects are acceptable.

The Corrective Actions program element of AMP XI.M27 was revised to recommend: (a) removal of material that is sufficient to obstruct piping or sprinkler systems; (b) flushes to remove loose fouling products that could cause flow blockage in the sprinklers; and (c) an evaluation to determine if deposits need to be removed to determine if loss of material has occurred.

Comment: 010

Surface exams for aluminum and stainless cracking are not necessary. Cracking can be seen visually prior to loss of intended function. Additionally, surface exams for opportunistic inspections are overly burdensome. (XI.M38)

RESPONSE:

The NRC staff did not agree with this comment. Surface examinations were not deleted; however, a change was incorporated that will provide more flexibility.

The NRC staff recognizes that VT-1 inspections are capable of detecting cracking. ASME Code Section XI, IWA-2211(a) states, "[a] VT-1 examination is conducted to detect discontinuities and imperfections on the surface of components, including such conditions as cracks, wear, corrosion, or erosion." In order to provide flexibility, the staff revised the Detection of Aging Effects program element to credit a VT-1 (with surface coverage recommendations) in lieu of a surface examination. The staff recognizes the aging effects for many components that are not within the ASME Section XI Code boundaries are managed by GALL-SLR AMP XI.M38, "Inspection of

Internal Surfaces in Miscellaneous Piping and Ducting Components." The staff cited VT-1 examinations for both Code and non-Code components because the ASME Code, Section XI has a set of industry consensus inspection parameters (e.g., illumination, distance, resolution, angle of view) suitable for detecting cracking.

A second alternative to surface exams was provided. The staff recognizes that cracks can occur that will not affect the structural integrity or intended function of a component. However, analyses must be conducted to determine the maximum size crack that could be allowed. As a result, routine visual inspections were incorporated into the AMP as long as it has been analytically demonstrated that surface cracks can be detected by leakage prior to a crack challenging the structural integrity or intended function of the component. The AMP also states that the SLRA includes an overview of the analytical method, input variables, assumptions, basis for use of bounding analyses, and results. The staff can verify the validity of the applicant's specific approach during its review of the SLRA and subsequent audit.

Comment: 011

NUREG–0619 should be sunset and XI.M5, BWR Feedwater Nozzle retired. (XI.M5)

RESPONSE:

The staff agreed with this comment. The AMP was deleted. Improvements in regulatory requirements for volumetric testing qualifications eliminate the need for the methods outlined in GALL-SLR AMP XI.M5 and make ASME Code methods in GALL-SLR AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections, IWB, IWC, and IWD," appropriate. The updated ASME Code methods include an approved Code case, which can be tied to the qualification requirements.

Comment: 012

Perform UT of the containment shell or liner surfaces inaccessible from one side on a random and focused basis each 10-year interval. (XI.S1)

RESPONSE:

The NRC staff partially agreed with the comment. The related descriptions in the Program Description and Detection of Aging Effects program element of GALL-SLR AMP XI.S1, "ASME Section XI, Subsection IWE," has been revised considering the comment to base the recommendation for supplemental ultrasonic testing (UTs) based on a trigger of plant-specific operating experience.

The last sentence in the last paragraph of the Program Description of GALL-SLR AMP XI.S1 has been revised to read as follows:

> The program is also supplemented to perform surface examination' of pressure-retaining components that are subject to cyclic loading but have no current licensing basis (CLB) fatigue analysis; and, based on plant-specific OE, a one-time volumetric examination of metal shell or liner surfaces that are inaccessible from one side.

The last paragraph of the Detection of Aging Effects program element of AMP XI.S1 has been revised to read as follows:

The requirements of ASME Code, Section XI, Subsection IWE and 10 CFR 50.55a are further supplemented to require a one-time volumetric examination of metal shell or liner surfaces that are inaccessible from one side, only if triggered by plant-specific operating experience ~~a during each inspection interval~~. The trigger for this supplemental examination is plant-specific occurrence of any instance of metal shell or liner corrosion initiated on the inaccessible side or areas, since the date of issuance of the first renewed license. ~~The~~ This supplemental volumetric examination consists of ~~(1) a sample of one-foot square randomly selected locations and (2)~~ a sample of one-foot square locations that included both randomly-selected, and focused on areas most likely to experience degradation based on operating experience and/or other considerations such as environment. Any identified degradation is addressed in accordance with the applicable provisions Subsection IWE. The sample size, locations, ~~frequency and schedule~~ and any needed scope expansion for ~~each~~ this one-time set of volumetric examinations should be determined on a plant-specific basis. ~~during each interval.~~ To demonstrate statistically with 95 percent confidence that 95 percent of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10 percent loss of nominal thickness. Guidance provided in EPRI TR-107514 may be used for sampling considerations."

The References section of AMP XI.S1 has been revised to add the following reference:

____. EPRI TR-107514, "Age-Related Degradation Inspection Method and Demonstration." In Behalf of Calvert Cliffs Nuclear Power Plant License Renewal Application. Palo Alto, California: Electric Power Research Institute. April 1998.

The staff agreed that operating experience should be an important consideration in determining additional supplemental volumetric examinations for potential corrosion initiated on the inaccessible side of a containment metal shell or liner. Therefore, the provision for supplemental volumetric examinations in AMP XI.S1 has been revised to a one-time examination based on a trigger of the plant-specific occurrence or reoccurrence of any instance of corrosion of the containment metal shell or liner initiated on the inaccessible side or areas, since the date of issuance of the first renewed license. This examination will consist of sample of both randomly-selected and focused locations most likely to experience degradation based on operating experience and other considerations such as environment. The sample size and locations are determined on a plant-specific basis to demonstrate statistically with 95 percent confidence that 95 percent of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10 percent loss of nominal thickness.

The staff further notes that it understands the requirements of the ASME Code, Section XI, Subsection IWE, as incorporated by reference in 10 CFR 50.55a. With regard to augmentations to the requirements of ASME Code Section XI in some AMPs, the commenter is referred to the Section entitled "References to ASME Code Section XI Used in This Report" in Chapter I of GALL-SLR Report. Aging management programs for a renewed license for long-term operations are primarily intended to address deltas in existing requirements such that aging effects on systems, structures, and components (SSCs) are adequately managed so that intended functions are maintained consistent with the current licensing basis (CLB) for the period of extended operation, and not meant to be an exact repetition of existing code requirements. Currently, there is no available operating experience of aging degradation of containment metal shell/liner for 60-80 years of plant operation. Most past cases of through-wall corrosion of the containment metal shell/liner have been attributed to the presence of foreign material due to inadequate practices/housekeeping at the time of construction, and there is no guarantee that such foreign material is not likely in other plants. Further, plant-aging degradation may be significant in the future from degradation processes, such as cracking, carbonation, and chloride ingress and may contribute to the initiation and propagation of corrosion degradation of the containment shell/liner on the concrete side. Containment design and operation also could be a contributing factor. The containment metal shell or liner serves a very important safety function to provide structural and/or leak-tight integrity under design basis loads under normal operation and accident conditions. Corrosion that originates between the shell/liner and concrete is a greater concern because the IWE visual examinations typically identify the corrosion only after it has significantly degraded the shell/liner (e.g., through-wall), as has been indicated in several instances of past operating experience described in several NRC Information Notices and technical reports. Based on review of past industry operating experience that addressed the cause and significance of localized through-wall or partial corrosion of containment metal shell or liner initiated on the inaccessible (shell/liner-concrete interface) side and considering the important safety function of the containment metal liner/shell, it is reasonable for the AMP for SLR to recommend a one-time supplemental volumetric examination that is based on a trigger of plant-specific occurrence or recurrence of shell/liner corrosion initiated on the inaccessible side, since the date of issuance of the first renewed license.

Any further actions are determined consistent with applicable provisions of the Subsection IWE AMP, based on the findings. The criteria provided for plant-specific determination of a statistically-based sample size and locations for this one-time trigger-based supplemental volumetric examination is consistent with that implemented by Beaver Valley, as part of its license renewal commitments to address their plant-specific operating experience of through-wall liner corrosion initiated on the inaccessible side. Additionally, the one-time trigger-based provision for supplemental volumetric examination provides a means of plant-specific verification that its operating experience of shell/liner corrosion initiated on the inaccessible surface, if observed in a later part of its service life, is not a larger issue beyond localized area(s), and a confirmation of the expected effectiveness of the AMP for long term operation to 80 years.

Comment: **013**

Perform surface examination of SS material and dissimilar welds of penetration sleeves and penetration and vent line bellows every 10 years regardless of cyclic loading, SCC, or whether CLB Fatigue analysis exists. (XI.S1)

RESPONSE:

The staff partially agreed with the comment. The GALL-SLR Report AMP XI.S1, "ASME Section XI, Subsection IWE." recommendations for surface examination to detect cracking, associated AMR items, and/or further evaluation is in principle, reverted similar to that in GALL Report Revision 2. However, due to lack of clarity in the AMP and/or inconsistency between related AMR items in these existing guidance documents, some changes have been made to the related GALL-SLR Report and SRP-SLR provisions to explicitly clarify the recommendations.

The applicable program elements of GALL-SLR AMP XI.S1 were revised as marked up below.

Source 014

The last sentence in the last paragraph of the Program Description of AMP XI.S1 has been revised as follows:

> *The program is also supplemented to perform surface examination' of pressure-retaining components that are subject to cyclic loading but have no current licensing basis (CLB) fatigue analysis; and, based on plant-specific OE, a one-time volumetric examination of metal shell or liner surfaces that are inaccessible from one side~~, during each inspection interval~~.*

3*. Parameters Monitored or Inspected:*

… distress of the underlying metal shell or liner. Steel, stainless steel (SS), and dissimilar metal weld pressure-retaining components ~~of penetration sleeves, penetration bellows, and vent line bellows; and, steel bellows components~~ that are subject to cyclic loading but have no current licensing basis (CLB) fatigue analysis (i.e., components coverd by Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Table 3.5-1, items 27 and 40, and corresponding GALL-SLR items, as applicable), are monitored for cracking. The moisture barriers are examined...

4*. Detection of Aging Effects:*

The requirements of ASME Section XI, Subsection IWE and 10 CFR 50.55a are supplemented to perform surface examination (or other applicable technique), in addition to visual examination, to detect cracking in~~(a)~~ steel, SS and dissimilar metal weld~~s~~ pressure-retaining ~~of penetration sleeves, penetration bellows, and vent line bellows;, and (b) steel bellows~~ components that are subject to cyclic loading but have no CLB fatigue analysis (i.e., components coverd by SRP-SLR Table 3.5-1, items 27 and 40, and corresponding GALL-SLR items, as applicable to the plant). ~~The supplemental surface examination of dissimilar metal welds may be performed in accordance with Table IWE-2500-1, Examination Category E-F, as specified in the 1995 edition with 1996 addenda of the ASME Code, Section XI, Subsection IWE. Components for which supplemental surface examination is not feasible are identified and~~ Where feasible, appropriate Appendix J leak rate tests (GALL-SLR Report AMP XI.S4) capable of detection of cracking may be performed or credited in lieu of the supplemental surface examination; the type of leak test determined to be appropriate is identified with the basis for components for which this option is used.~~justified to detect cracking are conducted in lieu of the supplemental surface examination. For two-ply bellows of the type described in NRC IN 92-20 for which it is not possible to perform a valid local leak rate test, augmented examination using qualified enhanced techniques that can detect cracking is recommended~~.

6*. Acceptance Criteria: ……………………………………… accordance with IWE-3122 or accepted by engineering evaluation. Cracking of steel, SS and dissimilar metal weld pressure-retaining components ~~of penetration sleeves, penetration bellows, and vent line bellows;, and steel bellows components~~ that are subject to cyclic loading but have no CLB fatigue analysis (i.e., components coverd by SRP-SLR Table 3.5-1, items 27 and 40, and corresponding GALL-SLR items, as applicable) is corrected by repair or replacement or accepted by engineering evaluation.*

GALL-SLR items II.A3.CP-37 and II.B4.CP-37 were revised to make the "Structure and/or component" column to be consistent with SRP-SLR item 3.5-1, 027.

GALL-SLR items II.A3.C-13 and II.B4.C-13 was revised to make the "Structure and/or component" column to be consistent with item 3.5-1, 009.

The “Further Evaluation” column was revised from “No” to “Yes” for the following GALL-SLR Report AMR items that correspond to SRP-SLR Table 3.5-1, items 038 and 039: II.B3.1.C-24, II.B3.2.C-24, and II.B1.1.CP-50. These conforming changes were intended to make SRP-SLR Table 3.5-1, items 038 and 039 consistent with item 010 for the “cracking due to SCC” aging effect/mechanism.

Changes to SRP-SLR:

SRP-SLR Table 3.5-1, item 027 was revised to make the components the same as for item 009.

The “Further Evaluation Recommended” column of SRP-SLR Table 3.5-1, items 038 and 039 were changed from “*No*” to “*Yes* (SRP-SLR Section 3.5.2.2.1.6) to make it consistent with the further evaluation for detection of aging effect due to SCC for similar SRP-SLR Table 3.5-1, item 010.

SRP-SLR further evaluation Section 3.5.2.2.1.6 was revised as shown below to be consistent with Table 3.5-1, items 010, 038, and 039:

3.5.2.2.1.6 Cracking Due to Stress Corrosion Cracking

Stress corrosion cracking (SCC) of stainless steel <u>penetration sleeves,</u> penetration bellows<u>, vent line bellows, suppression chamber shell (interior surface),</u> and dissimilar metal welds could occur in ~~all types of~~ PWR and<u>/or</u> BWR containments. The existing program relies on ASME Section XI, Subsection IWE and10 CFR Part 50, Appendix J, to manage this aging effect. Further evaluation<u>, including consideration of SCC susceptibility and applicable operating experience related to detection,</u> is recommended of additional appropriate examinations/evaluations implemented to detect ~~these~~ <u>this</u> aging effect for <u>these</u> SS <u>components</u> and dissimilar metal welds.

SRP-SLR further evaluation Section 3.5.3.2.1.6 was revised as shown below to be consistent with Table 3.5-1, items 010, 038, and 039:

3.5.3.2.1.6 Cracking Due to Stress Corrosion Cracking

Further evaluation is recommended of programs to manage cracking due to SCC for stainless steel penetration sleeves, <u>penetration bellows, vent line bellows, suppression chamber shell (interior surface), and</u> dissimilar metal welds~~, and penetration bellows~~ in ~~all types of~~ PWR and<u>/or</u> 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~~ <u>the listed SS components</u> and dissimilar metal welds<u>, considering SCC susceptibility and applicable operating experience (e.g., cracking of two-ply bellows) related to detection,</u> 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.

The provision for supplemental surface examination in GALL-SLR Report AMP XI.S1 is intended to address detection of fatigue damage (cracking) due to cyclic loads aging effect/mechanism covered by AMR items in SRP-LR Table 3.5-1, items 27 and 40, which are collectively intended to be the same as item 9 but for containment pressure-retaining components with no CLB fatigue analysis (i.e., the aging effect/mechanism is not managed by SRP-SLR Section 4.6 TLAA as for Table 3.5-1, item 009).

Supplemental surface examinations, in addition to code-based visual examinations, with capability to detect cracking is applicable for containment pressure-retaining boundary components based on considerations of cyclic loading (fatigue) and whether CLB fatigue analysis exists, and further evaluation of a plant-specific AMP or enhancement for stress corrosion cracking (SCC); with the alternate option of performing an appropriate leak rate test at least once every inspection interval and capable of detection of the aging effect, as was intended in the GALL Report Revision 2 and SRP-LR. To avoid potential requests for additional information, the method proposed to be employed for specific components should be described with the basis for timely detection of the aging effect.

Consistent with the related AMP and AMR provisions in the SRP-LR and GALL Report Revision 2, supplemental surface examinations are recommended to detect cracking due to cyclic loading for steel, stainless steel (SS) and dissimilar metal weld pressure-retaining components that are subject to cyclic loading but have no CLB fatigue analysis (i.e., components covered by SRP-LR Table 3.5-1, items 27 and 40, which is the same as item 9 but not managed by a CLB fatigue analysis TLAA, and corresponding GALL-SLR AMR items, as applicable to the plant). The components covered in these items may include penetration sleeves, penetration bellows, vent line bellows, suppression pool shell, dissimilar metal welds, metal liner, metal plate, personnel airlock, equipment hatch, and CRD hatch with no CLB fatigue analysis, as applicable to the plant.

Further, the need for supplemental surface examination to detect cracking due to SCC is recommended for stainless steel and dissimilar metal weld components [e.g., components corresponding to SRP-LR Table 3.5-1, item 10 (penetration sleeves and bellows), item 38 (suppression chamber shell inner surface), and item 39 (vent line bellows)] will be based on further evaluation of detection of aging effects, including consideration of susceptibility and applicable operating experience (e.g., two-ply bellows cracking) per SRP-SLR Section 3.5.2.2.1.6).

In principle, no new recommendations for supplemental surface examinations to address fatigue damage or SCC, than which already exists in related AMR items for which AMP XI.S1 is credited for aging management in GALL Report Revision 2 and SRP-LR, are being made in GALL-SLR or SRP-SLR. However, some changes are made in the AMP and related AMR items to ensure clarity in the AMP and/or to resolve inconsistency and component omissions between related AMR items in these existing guidance documents. The technical basis is the same as that documented collectively in sections/items that addressed the topic in NUREG–1950, “Public Comments and Technical Bases for Changes in the License Renewal Guidance Documents NUREG–1801 and NUREG–1800.” Refer to the following related sections/items in NUREG–1950, taken collectively.

1. For cracking due to cyclic loading with no CLB fatigue analysis: Table II-11, items II.B2.1.CP-107 (p II-268), II.B2.1-CP-142 (p II-284), II.A3.CP-37 and II.B4.CP-37 (p II-298), II.B1.1.CP-49 (p II-309), II.B2.2.CP-64 (p II-322); Table II-22, item XI.S1 ASME Section XI, Subsection IWE (p II-446 to II-448); Table IV-3, Comment 319 (p IV-25); Table IV-13, Comments 899 and 902 (p IV-277 to IV-279)

2. For cracking due SCC: Table II-11, items II.A3.CP-38 and II.B4.CP-38 (p II-301), II.B1.1.CP-50 (p II-309); Table IV-3, Comment 319 (p IV-25); Table IV-13, Comments 899 and 902 (p IV-277 to IV-279)

Where feasible, if an Appendix J leak test is used in lieu of recommended surface examination, the technical basis justifying an appropriate Appendix J test capable of early detection of fine cracks is provided in NUREG–1950, specifically Table II-11, items II.A3.CP-37 and II.B4.CP-37 (p II-298), II.A3.CP-38 and II.B4.CP-38 (p II-301); and Table II-22, item XI.S1 ASME Section XI, Subsection IWE (p II-446 to II-448). It is stated therein that visual examination may not detect fine cracks that may occur as a result of cyclic loading; therefore, supplemental surface examination is recommended. It is also stated therein that some penetration sleeves and bellows are not designed to allow for a local Type B pressure test, and that a Type A integrated leak rate test interval exceeding 10 years may not provide for early detection of cracking such that corrective actions are taken to prevent loss of primary containment leak-tightness. The related provision in the AMP that the type of leak test determined to be appropriate should be identified with the basis for components for which this option is used, is intended to avoid RAIs on this issue.

For AMR items corresponding to SRP-LR Table 3.5-1, items 38 and 39, the indication of “No” in the further evaluation column in Revision 2 of the SRP-LR and GALL-SLR Report implied that the IWE program included supplemental surface examination (refer to technical basis for changes in NUREG–1950, Table II-11, item II.B1.1-CP-50 (p II-309), and Table IV-3, Comment 899 (p IV-277). However, in SRP-SLR and GALL-SLR Report, these items will have a further evaluation to be consistent with Table 3.5-1, item 10 with similar material, environment, and aging effect/mechanism.

The staff further notes that cumulative fatigue damage, which is the subject of the issue here, is an applicable aging mechanism/effect in the GALL-SLR Report and SRP-LR for Class MC containment pressure-retaining components, including containment metal shell, penetration components, and metal liners of Class CC containments. For license renewal including SLR, this aging mechanism/effect can be addressed either through a TLAA, or by supplemental aging management method capable of detecting the aging effect. The ASME Code, Section III, Division 1 (incorporated by reference in 10 CFR 50.55a) or Section VIII, which are typically the code-of-record for metal containments, requires either a detailed fatigue analysis for cyclic operation or a fatigue waiver analysis considering cyclic loads over a design period, both of which qualify as a TLAA. The requirements of Section III, Division 1 are also invoked for liners in Division 2. Applicants for LR/SLR have the option to address the fatigue damage aging effect analytically through a TLAA to avoid having to manage the aging effect by alternate physical means such as supplemental surface or other enhanced examination methods capable of detecting fine cracks.

Comment: 014

Inspect additional 5% IWF piping supports for class I, II, and III every 10 years. (XI.S3)

RESPONSE:

The staff partially agreed with the comment and associated changes to the GALL-SLR Report have been made.

The population of supports that are currently inspected in accordance with 10 CFR 50.55a include the same supports each inspection interval. This nominal increase allows that supports that have never been inspected can be verified to be representative of the entire population of supports, or could identify aging that is occurring in supports that have never been inspected during the life of the plant. Although other programs, walkdowns, or inspections could potentially identify age-related degradation of IWF supports, they may not, or issues may not be dispositioned appropriately to the IWF AMP. Operating experience should be an important consideration in determining the need for additional activities for the 60–80-year period; however, the sample chosen at the time the IWE Code was implemented in accordance with 10 CFR 50.55a, the sample selection required by ASME did not necessarily consider different aging mechanisms and effects necessary to be covered by aging management under 10 CFR Part 54. Addition of a select number of random inspections and inclusive of aging effects or environment most susceptible to degradation allows for better assurance that the IWF aging management program sample will be representative of the aging of the entire component support population during the subsequent period of extended operation.

The AMP was revised to clarify that the sample size examined for ASME Class 1, 2, and 3 component supports is as specified in Table IWF-2500-1. The provisions of ASME Code, Section XI, Subsection IWF are supplemented to include a one-time inspection of an additional 5 percent of the sample size specified in Table IWF-2500-1 for Class 1, 2, and 3 piping supports. The one-time inspection is conducted within 5 years prior to entering the subsequent period of extended operation. The additional supports are selected from the remaining population of IWF piping supports.

Comment: 015

Visual inspection all IWF bolts; and volumetric of ASTM A325, A490, F1852, and F2280 bolts every 10 years. (XI.S3)

RESPONSE:

The staff partially agreed with the comment.

SCC is an applicable aging effect for high-strength bolting [actual measured yield strength greater than or equal to 150 ksi or, 1,034 megapascal (MPa)] in sizes greater than 1-inch nominal diameter in ASME Code applications, and therefore retained in GALL-SLR AMP XI.S3, "ASME Section XI, Subsection IWF." There is relevant operating experience (OE) in EPRI NP-5769, Volume 1, "Degradation and Failure of Bolting in Nuclear Power Plants," of brittle failure of nuclear steam supply system (NSSS) support bolting due to SCC, and the staff position is that for aging management, high strength bolts with the properties described above that are included in ASME IWF applications, volumetric examinations should be performed for a sample of the bolts to determine whether cracking due to SCC has occurred. Note, this is not a change from the previous recommendation, it is a clarification that bolts meeting the criteria are subject to volumetric examination. The staff removed specific mention of ASTM A325 bolts because it is not likely that ASTM A325 bolting meeting the criteria is used. Also note that volumetric examinations may be waived with adequate plant-specific justification. This plant-specific justification would need to consider the population of high-strength bolts in IWF supports and determine on a component basis whether SCC is a credible aging effect. An example could include a detailed evaluation of SCC susceptibility with verification of a non-corrosive environment, and/or a one-time volumetric examination to confirm SCC is not occurring. A490 bolts are not considered exempt from volumetric examination on a material basis alone.

Comment: 016

UT of high strength bolts every 5 years on Refueling Crane structural members. (M23)

RESPONSE:

The staff agreed with this comment. References to volumetric and surface examination of crane bolting was removed. Based on the staff's review of ASME B30.2, an industry consensus standards document, visual inspections are appropriate to detect aging effects for all crane members including bolting. The staff has not identified any operating experience that would result in a need to augment the inspections cited in the ASME standards during the subsequent period of extended operation.

Comment: 017

Increased frequency inspection every 3 years (vs 5 years previously) for unbraced and unreinforced masonry walls. (XI.S5)

RESPONSE:

The NRC staff agreed with this comment and associated changes to the GALL-SLR Report have been made. The AMP was changed to:

> Visual examination of the masonry walls by qualified inspection personnel is sufficient. In general, masonry walls are inspected every 5 years. Provisions exist for more frequent inspections in areas where significant loss of material, cracking, or other signs of degradation are observed to provide reasonable assurance that there is no loss of intended function between inspections.

Comment: 018

New requirement–seasonally perform through-wall leakage or groundwater infiltration quantification and chemistry analysis. (XI.S6) (XI.S7)

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The discussion in Element 4 regarding corrective actions was replaced with wording recommending an assessment of possible aging effects caused by groundwater in-leakage. Additionally, the word "may" was added to the guidance in Element 4 related to what information should be included in the assessment.

Requiring monitoring of volume and chemistry is not overly prescriptive. There is significant operating experience from recent license renewal application reviews with licensees finding through-wall leakage acceptable as-is with little or no evaluation. The staff does not consider through-wall leakage acceptable and expects some form of assessment to be completed when leakage is identified. Furthermore, the staff did not agree that monitoring the leakage is not feasible and that monitoring does not provide useful data. Significant changes in the volume or chemistry data of the leakage could be a leading indicator of concrete or reinforcing steel degradation. The guidance allows licensees to determine the appropriate parameters monitored along with the frequency of the monitoring and to determine what additional actions need to be taken based on the results of monitoring.

Comment: 019

Perform focused inspections of below grade inaccessible concrete exposed to aggressive groundwater/soil every 5 years frequency. (XI.S6) (S7)

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The wording in Element 4 has been revised to allow more flexibility in the actions taken when concrete is exposed to aggressive groundwater.

The staff agreed that the recommendation may be overly prescriptive and burdensome. Licensees should be allowed the flexibility to decide the best method for managing their inaccessible concrete. However, the staff believes the evaluation and any associated actions should occur every 5 years.

Comment: 020

Testing of in scope inaccessible Non EQ instrumentation & control cables every 6 years. (XI.E3B)

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. The findings of the initial one-time test are evaluated to determine whether periodic testing of the cable connections is warranted. This finding forms the basis of site-specific OE for age-related degradation and informs the need for subsequent testing on a 10-year periodic basis.

The Detection of Aging Effects program element states that for inaccessible instrumentation and control cables exposed to significant moisture, visual inspection frequency is adjusted based on inspection and test results, as well as plant-specific and industry OE. For inaccessible and underground instrumentation and control cables exposed to significant moisture where testing is required, a one-time test is performed. Visual inspection occurs at least once every 6 years and may be coordinated with the periodic inspection for water accumulation.

Comment: 021

Testing of in scope inaccessible low voltage (below 400v) every 6 years. (XI.E3C)

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. The findings of the initial one-time test are evaluated to determine whether periodic testing of the cable connections is warranted. This finding forms the basis of site-specific OE for age-related degradation and informs the need for subsequent testing on a 10-year periodic basis.

The Detection of Aging Effects program element states that for inaccessible instrumentation and control cables exposed to significant moisture, visual inspection frequency is adjusted based on inspection and test results, as well as plant-specific and industry OE. For inaccessible and underground instrumentation and control cables exposed to significant moisture where testing is required, a one-time test is performed. Visual inspection occurs at least once every 6 years and may be coordinated with the periodic inspection for water accumulation.

Comment: **022**

Increased metal enclosed bus bolted inspection testing from a 20% sampling to 100% every 10 years. (XI.E4)

RESPONSE:

The staff agreed with the comment. The associated changes were made to the GALL–SLR Report. A sample of accessible bolted connections is inspected for increased resistance of connection by using thermography or by measuring connection resistance using a micro ohmmeter. Twenty percent of the population with a maximum sample size of 25 constitutes a representative sample size of the total population.

Comment: **023**

Change non-EQ connection inspections from one time before PEO to every 10 years. (XI.E6)

RESPONSE:

The NRC staff partially agreed with the comment and associated changes were made to the GALL-SLR Report.

The staff added testing on a one-time test basis or at least once every 10 years if only visual inspection is used to provide an indication of the integrity of the cable connections. Depending on the findings of the one-time test, subsequent testing may have to be performed within 10 years of initial testing. The first visual inspections or tests for license renewal are to be completed prior to the subsequent period of extended operation.

The findings of the initial one-time test are evaluated to determine whether periodic testing of the cable connections is warranted. This finding forms the basis of site-specific operating experience for age-related degradation and informs the need for subsequent testing on a 10-year periodic basis. The justification and technical basis for not performing subsequent periodic testing is documented. This includes a discussion of the types of unacceptable conditions or degradation identified and whether they were determined to be age-related, requiring periodic maintenance. Electrical cable connections exposed to appreciable ohmic or ambient heating during operation may experience increased resistance of connection caused by repeated cycling of connected loads or by the ambient temperature environment. Different materials used in various cable system components can produce situations where stresses between these components change with repeated thermal cycling.

Source 015: NEI Attachment 2—Mechanical Comments (non-AMP)

Comment: 001

Location of Change

SRP

FE 3.1.2.2.9
Table 3.1.1, 118
Table 3.1.1, 119

GALL

IV.B2.R-423
IV.B2.R-424
IV.B3.R-423
IV.B3.R-424
IV.B4.R-423
IV.B4.R-424

Description of Change

The GALL XI.M16A program has been deleted and management of cracking and loss of fracture toughness for PWR reactor vessel internal components is recommended by a plant-specific program. Consider restoring the XI.M16A program to GALL with reference to the industry action to update to 80 years, and recommending the use of this program to manage aging of PWR reactor vessel internal components.

Justification For Change

The XI.M16A program is based on implementation of the guidance in MRP-227-A, which has been reviewed and accepted by the NRC. By deleting XI.M16A now, the staff is effectively saying that there are no generic aging lessons learned for managing PWR vessel internals and that previous generic lessons learned are of no use for SLR. MRP-227-A has introduced methodologies and guidance that are of great benefit to aging management. NEI 03-08 mandates licensee implementation of MRP-227 into their aging management programs, and the industry has initiated a project to address the additional aging considerations for the 60–80-year licensing period. The industry believes the best way to address management of reactor internal components is to continue use of the MRP-227-A methodology and guidance, and update it as new insights become available. To abandon this guidance and require a plant-specific AMP and basis for individual applicants would impose a substantial burden with no additional safety benefit. The aging effects being managed are not expected to be discontinuous after 60 years such that a complete break with MRP-227-A guidance is indicated. The MRP update is expected to be completed in 2020, and the first reactor could enter the second PEO in 2027. Identifying the need to update to the new MRP-227 within the XI.M16A program provides a link to ensure applicants continue to use the best available guidance, and incorporation of MRP updates can be confirmed through the 71003 inspection. Additionally, any issue that might prevent an approved update to MRP-227 could be addressed by a license renewal ISG, or by generic or even licensee-specific communications.

This recommendation is expected to result in better aging management of the reactor internals, and in greater GALL consistency and review efficiency, as use of a Table 2 note E and evaluation of differing AMP descriptions will not be required.

RESPONSE:

This comment is analogous to the comment made in Comment No. 001 from Source 014 (i.e., as associated with Comment Issue 014-001. The staff agreed with this comment and associated changes to the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report have been made. The staff agreed that an aging management program (AMP) that employs the methodology in Topical Report No. Materials Reliability Program (MRP)-227-A may be used as the starting point for an AMP that will be used to manage the aging effects of pressurized water reactor (PWR) vessel internals, as long as it is supplemented with a submittal of a gap analysis methodology that identifies the potential changes that may need to be made to the methodology in MRP-227-A in order to account for the additional 20 year of licensed operations that would occur during a subsequent period of extended operations (i.e., to account for a total of 80 years of licensed operations. For more information, refer to the staff's bases for resolving the comment associated with Comment Issue 014-001.

Comment: 002

Location of Change

SRP

Table 3.1.1-38

GALL

IV.C1.R-08
IV.C2.R-08

SRP

Table 3.1.1-50

GALL

IV.C1.R-52
IV.C2.R-52

Description of Change

IV.C1(C2).R-08/3.1.1-38 no longer lists CASS pump casings with valve bodies as not requiring screening for thermal embrittlement susceptibility (e.g., acceptability of XI.M1 ISI as AMP). Similarly, IV.C1(C2).R-52 now includes CASS pump casings, and 3.1.1-50 text says "Cast austenitic stainless-steel Class 1 piping, piping component (including pump casings and control rod drive pressure housings) exposed to reactor coolant >250 degrees F (>482 degrees C)," with management by the M12 CASS thermal embrittlement program. Restore pump casings to XI.M1 management rows, and remove pump casings from XI.M12 management rows.

Justification For Change

Note that the May 19, 2000 Grimes letter provided screening exclusions that referenced Code Case N-481, which has been annulled. By practice, ASME Section XI code cases are annulled when the appropriate provisions of the case have been incorporated into the Code and that edition/addenda of the code has been endorsed by NRC in 10 CFR 505.55a. Since N-481 has been annulled, the conclusion is the code committee incorporated the appropriate elements of the case into the code itself. Further, it was in an edition or addenda NRC has endorsed in 10 CFR 50.55a. Since ASME did not include the screening for susceptibility provisions of the code case in the code and since NRC did not condition the use of the code it is logical to conclude that the screening is not needed. As such, the use of the code case should be dropped from GALL-SLR and Section XI as written is adequate for use. Screening of CASS pump casings for thermal embrittlement susceptibility should not be needed, ASME code inspection requirements are sufficient.

RESPONSE:

The staff did not agree with this comment and no changes were made to the GALL-SLR Report or Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR).

The comment conveys the commenter's opinion that the aging management review (AMR) criteria for ASME Code Class 1 pump casings should not be moved into the scope of SRP-SLR AMR item 3.1-1, 050 or into GALL-SLR Report AMR items IV.C1.R-52 or IV.C2.R-52. This is because the components were not subject to the criteria in AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," in the previous versions of the NUREG reports (i.e., in NUREG–1800 and NUREG–1801) or in the staff's previous license renewal issue document on the issue, which is given in NRC License Renewal Issue Document No. 98-0030, dated May 19, 2000 (ADAMS Accession No. ML003717179). The comment also conveys the commenter's perspective that: (a) loss of fracture toughness due to thermal aging embrittlement in Class 1 pump casings made from CASS is not a sufficient issue such that the components would not need to be subject to the supplemental susceptibility or flaw analysis criteria for CASS components in AMP XI.M12, and (b) the AMR items for these components should remain within the scope of the AMRs in GALL-SLR AMR items IV.C1.R-08 and IV.C2.R-08 and SRP-SLR AMR item 3.1-1, 038.

Specifically, the staff's changes to the relevant AMR items were based on two technical changes that were incorporated into the staff's update of GALL-SLR Report AMP XI.M12. First, the staff modified the AMP to remove language that excludes pump casings from the additional aging management recommendations of AMP XI.M12. The basis for this change is that former ASME Code Case N-481 specified additional visual examination and flaw tolerance evaluation criteria requirements for ASME Code Class 1 pump casings that would need to be implemented as an alternative to the volumetric examinations that are required for these components in Section XI of the ASME Boiler and Pressure Vessel Code. However, although the provisions of ASME Code Case N-481 have been incorporated in more recent editions of ASME Code Section XI and the code case has been withdrawn by the ASME Main Committee, not all of the provisions of the code case were incorporated into the ASME Code Section XI. Specifically, the staff determined that the updated editions of ASME Code Section XI did not incorporate the supplemental flaw tolerance evaluation requirements that were required for the pump casings in ASME Code Case N-481. Therefore, the staff decided that pump casings should be subject to the recommendations of AMP XI.M12, including those program element criteria in the AMP that are implemented to screen for thermal embrittlement and other actions in the AMP, such criteria for performing enhanced inspections or component-specific flaw evaluations of the pump casings if the screening criteria are not met.

Alternatively, if applicants can demonstrate that the previous flaw tolerance evaluation used to support implementation of ASME Code Case N-481 alternative inspection requirements remains bounding for 80 years, or if the previous flaw tolerance evaluation is revised to be applicable to an 80-year licensed service life, no further actions inspecting the pump casings would necessary for the subsequent period of extended operation beyond those specified for the components using GALL-SLR Report AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, or IWD” program.

Second, under the Detection of Aging Effects program element for the AMP XI.M12, ASME Code Case N-824 may be used as an acceptable method of performing ultrasonic (UT) examination of CASS piping and piping components, as conditioned by 10 CFR 50.55a. This change is based on the recommendation of NRC staff experts in nondestructive evaluation and the fact that ASME Code Case N-824 has been approved by the ASME Code and will be incorporated with conditions, in the next rulemaking revising 10 CFR 50.55a.

Therefore, the staff continues to find it appropriate to delete Class 1 CASS pump casings from the scope of GALL-SLR Report AMR items IV.C1.R-08 and IV.C2.R-08, and from the scope of SRP-SLR AMR 3.1-1, 038. Instead, aging management of loss of fracture toughness due to thermal aging embrittlement in Class 1 pump casings is adequately addressed by the changes the staff has made to GALL-SLR AMP XI.M12 and by the addition of pump casings to GALL-SLR Report AMR items IV.C1.R-52 and IV.C2.R-52, and SRP-SLR AMR item 3.1-1, 050. Class 1 pump casings made from CASS will now be subject to the supplemental assessment criteria for these types of components in the updated version of GALL-SLR Report AMP XI.M12.

Comment: 003

Location of Change

SRP Tables

3.1-1, 133
3.2-1, 90
3.3-1, 193
3.4-1, 81

GALL Tables

IV.A1.R-448	V.B.E-434	VII.E1.A-439	VIII.B1.S-432	VIII.F.S-432
IV.C1.R-448	V.C.E-434	VII.E3.A-439	VIII.B2.S-432	VIII.G.S-432
IV.C2.R-448	V.D1.E-434	VII.E4.A-532	VIII.C.S-432	GALL IX.F
IV.D1.R-448	V.D2.E-434	VII.E5.A-469	VIII.D1.S-432	GALL XI.M32
IV.D2.R-448	VII.A4.A-439	VII.G.A-651	VIII.D2.S-432	
V.A.E-434	VII.C1.A-469	VIII.A.S-432	VIII.E.S-432	

Description of Change

SLR GALL includes 27 new rows for “Any” component/Steel/in Reactor coolant, Treated water, Raw water and Waste water environments/for “Long-term loss of material due to general corrosion”/recommending only M32 (One-Time Inspection). Recommend deleting these newly added GALL / SRP rows, the definition in IX.F and the treatment in AMP XI.M32.

SLR Supplement Related

Justification For Change

The Statements of Consideration (SOC), (60 FR 22461 et al), page 22463 states that “(1) The intent of the license renewal review has been clarified to focus on the adverse effects of aging rather than identification of all aging mechanisms.” It is not a requirement of the Rule to identify all “mechanisms” of aging, only the effects of aging. Adding this new term adds confusion, not clarity. “Long-term loss of material due to general corrosion” presents the same effect as “loss of material due to general corrosion”—i.e., dissolution of metallic material due to an electrochemical process involving the metal and water. There is no distinction between “aging” and “long-term aging.” The new GALL has not identified any industry OE or issues that would present a different form of aging, nor aging effect, such as “long-term loss” as opposed to “aging-related loss”; so again there appears to be no justification for the addition of this term, nor for addition of any attendant AMR line items.

Loss of material for steel (due to general corrosion, as well as other mechanisms) in treated water environments is already identified in other GALL rows as a potential aging effect, with recommendation for management with XI.M2 (Water Chemistry) and XI.M32 (One-Time Inspection). The XI.M32 program Table XI.M32-1 includes visual (e.g., VT-3) or volumetric examination recommendations that are capable of identifying loss of material due to general corrosion without the need for the additional Long-term loss of material row.

The use of XI.M32 (One-Time Inspection) to confirm the absence of aging effects in raw water and waste water appears to be inadequate, as loss of material due to general corrosion (and other mechanisms) is expected in these environments. Existing GALL rows provide for management of loss of material due to general corrosion of steel in raw water and waste water environments with ongoing programs such as XI.M20 (Open-Cycle), XI.M27 (Fire Water) or XI.M38 (Inspection of Internal Surfaces). These programs provide for inspections that are capable of identifying loss of material due to general corrosion.

RESPONSE:

The staff did not agree with this comment. The industry’s “Justification for Change,” cited several reasons for deleting the new items. The staff’s response to these statements follows. In addition, this response encompasses a similar comment, Comment 045-080, received on the SRP-SLR Supplemental Staff Guidance document.

- *There is no distinction between “aging” and “long-term aging.”* Original plant designs should have included at least a 40-year corrosion allowance for steel systems. For steel systems exposed to water environments without corrosion inhibitors, it is appropriate to confirm that the rate of loss of material will not challenge the structural integrity of these systems throughout an 80-year span of operation. The NRC staff incorporated the term “long term loss of material” to differentiate it from the term “loss of material.” Long term loss of material is addressed once prior to entering the subsequent period of extended operation, as long as the results of the volumetric examinations establish that the structural integrity intended function(s) of the in-scope components will be met until the end of 80 years of operation. In contrast, loss of material is addressed in periodic or opportunistic inspections conducted throughout the subsequent period of extended operation.

- *The XI.M32 program Table XI.M32-1 includes visual (e.g., VT-3) or volumetric examination recommendations that are capable of identifying loss of material due to general corrosion without the need for the additional Long-term loss of material row*: The NRC staff does not dispute that Table XI.M32-1, "Examples of Parameters Monitored or Inspected and Aging Effects for Specific Structure or Component," recommends "surface condition or wall thickness" as a means to detect loss of material. However, the staff has concluded that due to the potential for uniform loss of material, it may not be possible to visually detect loss of material that has accumulated over a long period of time. As a result, for long-term loss of material, only volumetric wall thickness measurements are recommended.

- *Other programs (e.g., AMP XI.M20, AMP XI.M27, AMP XI.M38) could be used to confirm the absence of this aging effect*: The staff does not dispute that other programs, as cited in the comment, can be used to manage loss of material. However, none of these programs exclusively recommend the use of wall thickness measurements. Specifically:

  - AMP XI.M20, "Open-Cycle Cooling Water System," would only result in wall thickness measurements if the applicant's response to Generic Letter (GL) 89-13 included these inspections or the applicant has adopted the use of wall thickness measurements.

  - AMP XI.M27, "Fire Water System," only recommends wall thickness measurements if, "surface irregularities that could be indicative of an unexpected level of degradation due to corrosion and corrosion product deposition," or if normally dry but periodically wetted piping is not configured to drain.

  - AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," does not exclusively recommend wall thickness measurements for this material, environment, and aging effect combination.

- *Comment 045-080, in relation to the SRP-SLR Supplemental Staff Guidance document, additionally stated that long-term loss of material could be managed by reviews for recurring internal corrosion (RIC) (e.g., SRP-SLR Section 3.3.2.2.7)*: The NRC staff did not agree with this comment. Reviews for RIC and the accompanying changes to AMPs would only occur if the criteria for RIC were met (i.e., reduction in wall thickness greater than 50 percent). Long-term loss of material addresses uniform general corrosion, as well as pitting, etc. The evaluation for RIC would not necessarily encompass long-term loss of material unless through-wall loss of material occurred or the licensee was conducting volumetric wall thickness measurements and discovered locations with greater than 50 percent wall loss.

- *Comment 045-080, in relation to the SRP-SLR Supplemental Staff Guidance document, additionally stated that long-term loss of material is not being driven by industry OE*: The NRC staff did not agree with this comment. General corrosion of steel exposed to water without corrosion inhibitors will occur. Various rates have been published.

- http://bondwater.com/docs/techpapers/corrosion_rates.pdf, accessed on June 27, 2016. Rates varied from 0 to 1 mil per year (mpy) for excellent water conditions, 1–3 mpy for mild or very good conditions, 3–5 mpy for good conditions. Loss of material rates can be as high as 5–8 mpy in moderate to fair conditions and 8–10 mpy in poor conditions.

- Corrosion, 3rd Edition, Volume 1, LL Shreir, Elsevier, 1994, Table 3.6, "Rates of rusting of mild steel in natural waters (total immersion)." Based on a 15-year test in a fresh water reservoir, the rate was 1.7 mpy. In very pure river water, the rate was 2.7 mpy.

- Cooling Water Treatment – Principles and Practice, Colin Frayne, Chemical Publishing Company Inc., 1999, Table 4-3, "Starting Point for Specifying and Quantifying Corrosion Rates." For open cooling water systems rates ranging from 2–4 mpy for mild conditions, 4–6 mpy for moderate conditions, and greater than 10 mpy in sever conditions.

The corrosion rate will vary from plant to plant; however, even at the lower end of the rates, even a couple of mils per year accumulated over an 80-year period could result in challenges to the structural integrity of in-scope components. Therefore, although the staff did not cite nuclear-specific operating experience (OE), there is abundant industrial OE to demonstrate that long-term loss of material could be impactful.

- *Comment No. 80, in relation to the SRP-SLR Supplemental Staff Guidance document, additionally stated that the staff does not have industry OE demonstrating that internal visual inspections have been ineffective at detecting loss of material*: The staff believes that internal visual examinations are an effective means to detect general corrosion and localized corrosion such as pitting or crevice corrosion. However, given that uniform loss of material will probably not be detected by visual inspections, the staff has concluded that a one-time volumetric inspection of a representative sample of piping during the 10-year prior to the period of extended operation is appropriate.

The staff acknowledges that, based on the staff's review of AMPs during AMP audits, many licensees have initiated wall thickness measurements for steel piping exposed to raw water. As a result of these observations, the staff included a provision in the scope of program element to state that one representative sample (in lieu of periodic samples) conducted in the 10-year period prior to the subsequent period of operation is sufficient to satisfy the recommendation in AMP XI.M32, "One-Time Inspection." This change was incorporated into the GALL-SLR and SRP-SLR Supplemental Staff Guidance document.

The staff discussed long-term loss of material with the industry during a public meeting conducted on June 1, 2016. The staff agreed to add long-term loss of material to GALL-SLR Chapter IX.E in order to differentiate the term from loss of material. In addition, the staff agreed that the following changes to AMP XI.M32 would clarify the staff's intent and avoid unnecessary exceptions in subsequent license renewal applications (SLRAs). Exceptions would not be required for: (a) conducting wall thickness measurements for long-term loss of material in a different AMP (e.g., AMP XI.M20) as long as the alternative AMP cites the necessary detail (e.g., environment, sample size, purpose of inspection); (b) utilization of the data from recurring internal corrosion wall thickness measurements as long as the material and environment is consistent with that for long-term loss of material; and (c) the use of scanning techniques (e.g., low frequency electromagnetic testing) as long as the method, coverage, and threshold for follow-up wall thickness measurements when indications are detected are stated in the SLRA.

Comment: 004

Location of Change

SRP FE

3.2.2.2.10
3.3.2.2.10
3.4.2.2.7

SRP Tables

3.2-1, 102
3.3-1, 186
3.4-1, 102

GALL rows

V.D1.E-445
V.D2.E-445
VII.C3.A-482
VII.E5.A-482
VII.H1.A-482
VIII.E.S-450
VIII.G.S-450

Description of Change

Multiple new GALL/SRP Table 1 rows address cracking of aluminum due to SCC.

Recommendations:

Delete the FE text "The susceptibility of the material is to be established prior to evaluating the environment."

Revise FE "Aggressive Environment" text to clarify that indoor air is not expected to be aggressive provided condensation is not expected, and delete indoor air environments from the SRP Table component descriptions and from the associated GALL AMR lines

Provide None/None aging effect/AMP rows for Aluminum (where material is non-susceptible or the environment is not aggressive). See comment 5 for aluminum loss of material comment.

Delete the recommendation to use the XI.M42 coatings program to manage a coating barrier to aggressive environments.

SLR Supplement Related

Justification For Change

- As explained in the FE text, absence of cracking is expected for either non-susceptible materials or non-aggressive environments. In some cases, determining a specific alloy may be very difficult, but the environment may be known to be non-aggressive. It's not necessary to establish the specific alloy to exclude the aging effect if the component is indoors and not subject to condensation (i.e., within an Air-indoor uncontrolled or Air-indoor controlled environment).

- Indoor air is not expected to support cracking of aluminum unless condensation is expected. For components that operate below ambient temperature, the "Condensation" environment would result in the expectation of cracking for susceptible alloys. Absence of cracking in (non-wetted) indoor air is consistent with EPRI 1010639 (Mechanical Tools), which specifies that in addition to a susceptible alloy, cracking of aluminum is applicable when the external surface is buried or exposed to a concentration of contaminants, or is exposed to an aggressive environment in outdoor locations. A concentration of contaminants is considered to be present when "prolonged or frequent wetting (e.g., from condensation, leakage, ponding/pooling) or alternate wetting and drying can concentrate contaminants from the atmosphere and they can thereby become aggressive species for metals. Infrequent or intermittent wetting (e.g., limited time periods with condensation) are not expected to concentrate contaminants sufficiently to become aggressive for metals." This conclusion is also consistent with the further evaluation text at the end of the subject paragraph ("… aqueous solutions and atmospheric air, such as outdoor air, raw water, waste water, and condensation,…"), and with GALL AMR rows for aluminum piping and piping components other than the XI.M29 Tank rows (e.g., E-443, E-444, E-452, E-453, A-623, A-429, A-451, A-452, A-706, A-750, A-753, A-762, S-457, S-458, S-459, S-460). These rows roll up to these FE topics, but do not include indoor air as an applicable environment for cracking of susceptible alloys.

- There are no GALL rows provided for None/None aging effects and programs, when neither cracking nor loss of material (see comment 5) is applicable.

- It's unlikely that applicants would credit a coating to provide a barrier to an aggressive environment for these components. If an applicant chose to do so, it would require a note E for a different program either with or without this text. Additionally, the XI.M42 program scope is clearly defined to be internal coatings. Use of this program to manage external coatings may be interpreted as a program exception.

RESPONSE:

The NRC staff's disposition of comments are individually addressed for each portion of the comment as follows:

- The NRC staff partially agreed with this portion of the comment. The change was incorporated as requested. It is immaterial to the final technical conclusions developed by the staff whether the material is demonstrated to be not susceptible or the environment is demonstrated to not be aggressive. However, demonstrating that an environment is not susceptible has typically resulted in more questions by the staff related to issues such as contents of the cooling tower plume, composition of insulation, etc. The staff has concluded that the second half of the industry's basis for this comment related to the aggressiveness of indoor air environments is not accurate. See the response to Part No. 2 of this comment.

- The staff did not agree with this portion of the comment. The staff has concluded that the indoor air environment can be aggressive even in the absence of condensation. Aggressive environments that are known to result in cracking of susceptible aluminum alloys due to stress corrosion cracking (SCC) are aqueous solutions contain halides (e.g., chloride). Insulation is a potential significant source of halides whether it is installed on the in-scope component or on components in the vicinity of the in-scope component. In a controlled or uncontrolled indoor-air environment, sufficient halide concentrations to cause SCC could be present due to leakage from nearby components or the component itself (e.g., leakage from flanged connections or valve packing). In addition to potential halides in the insulation, raw water lines could contain halides (e.g., salt water). The staff accepts that pressure boundary leakage would be considered as event driven and not as a potential source to transport halides to the surface of the aluminum component. However, SRP-SLR Section A.1.2.1 states that, "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."

- The staff did not agree with this change. The staff has concluded that it is not appropriate to establish an item citing no aging effect and no recommended AMP for aluminum exposed to an air environment or condensation. It could be demonstrated that cracking is not an applicable aging effect by demonstrating that the environment is not aggressive. However, one of the purposes of GALL-SLR AMP XI.M32, "One-Time Inspection," is to conduct inspections when an aging effect is not expected to occur, but the data are insufficient to rule it out with reasonable confidence. The staff has concluded that an OE search and at least a one-time inspection are necessary to demonstrate that aging effects are not applicable for aluminum components exposed to any air environment or condensation. As a result, there would always be an applicable AMP for this material and environment combination. In contrast, the further evaluation sections state that, "[i]f the material is not susceptible to SCC, then cracking is not an aging effect requiring management." As a result, an OE search and a one-time inspection would not be required.

The staff has concluded that it will not eliminate GALL-SLR AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," as a potential AMP to manage aging effects associated with aluminum components exposed to any air environment or condensation. In accordance with the industry's comment No. 5 Part No. 1, the staff is establishing GALL-SLR AMR items that cite various acceptable programs as cited in the further evaluation sections. As a result, AMP XI.M42 could be cited as a consistent AMP and generic note E would not need to be cited or justified. In regard to AMP XI.M42 being associated with internal coatings, the further evaluation sections (e.g., Section 3.2.2.2.13) state, "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 for internal or external coatings."

<u>Comment</u>: <u>005</u>

Location of Change

SRP FE

3.2.2.2.13
3.3.2.2.13
3.4.2.2.10

SRP Tables

3.2-1, 56
3.2-1, 105
3.2-1, 111
3.3-1, 223
3.3-1, 227
3.3-1, 234
3.4-1, 94
3.4-1, 97
3.4-1, 113

GALL AMR rows

V.F.EP-3
V.D1.E-448
V.D2.E-448
V.E.E-454
VII.I.A-752
VII.C3.A-756
VII.E5.A-756
VII.H1.A-756
VII.J.A-763
VIII.H.S-442
VIII.E.S-445
VIII.G.S-445
VIII.I.S-461

Description of Change

Multiple new or revised GALL rows address loss of material for aluminum in air environments that include indoor air and specify a Plant-specific AMP. These rows roll up to Table 1 lines that recommend further evaluation. Recommendations:

- Modify/add GALL/SRP rows for aluminum in air environments such that loss of material for aluminum is managed by an appropriate program (XI.M29 Aboveground Metallic Tanks, XI.M36 External Surfaces, XI.M38 Inspection of Internal Surfaces or XI.M41 Buried and Underground Piping and Tanks).

- Revise the FE sections to address a site-specific OE review to confirm that loss of material due to aging for aluminum components exposed to indoor air (other than condensation) has not been identified. If site OE indicates that aluminum exposed to indoor air (i.e., not condensation, not underground locations) has experienced loss of material due to aging, then one of the above AMPs should be assigned. Delete reference to a one-time inspection.

- Restore None/None rows for Aluminum in air-indoor uncontrolled and air-indoor controlled to be used if the site OE review does not identify aging of aluminum exposed to air-indoor uncontrolled or air-indoor controlled.

SLR Supplement Related

Justification For Change

FE sections state that loss of material may be expected in the presence of halides and moisture.

- The addition of line items to specify the various acceptable programs is recommended to provide GALL matches in the Table 2s such that note E does not need to be used for a program assignment that is recommended by the SRP.

- Loss of material for aluminum is expected in outdoor environments and in indoor wetted environments (i.e., condensation). This susceptibility is identified in EPRI 1010639 (Mechanical Tools) which specifies that loss of material of aluminum is applicable when the surface is buried or exposed to a concentration of contaminants, or is exposed to an aggressive environment in outdoor locations. A concentration of contaminants is considered to be present when "*prolonged or frequent wetting (e.g., from condensation, leakage, ponding/pooling) or alternate wetting and drying can concentrate contaminants from the atmosphere and they can thereby become aggressive species for metals. Infrequent or intermittent wetting (e.g., limited time periods with condensation) are not expected to concentrate contaminants sufficiently to become aggressive for metals.*"

  Normal indoor air environments (Air-indoor uncontrolled, Air-indoor controlled) do not support wetting that would be expected to cause loss of material for aluminum, as confirmed by the GALL IX.F definition of these environments (wetting is not normally expected). If conditions may result in wetting, "Condensation" is specified and loss of material would be expected.

  The FE sections recommend that leakage of fluids from mechanical connections, such as bolted flanges and valve packing, through insulation onto a component in indoor controlled air is identified as a water source that should be considered. However, in accessible areas, leakage does not result in a long-term wetted environment to be evaluated for aging. Leakage is an event, and does not represent a long-term environment that causes aging. Identified leakage and its effects are addressed through the corrective action program. It is appropriate to consider underground environments as potentially aggressive.

  In the absence of site specific OE that identifies degradation of aluminum in indoor air, a plant-specific program to confirm the absence of aging effects in aluminum exposed to indoor air is not warranted.

This recommendation is expected to result in better and more consistent aging management and improved review efficiency, as evaluation of a plant-specific AMP as identified by a Table 2 note E will not be required.

RESPONSE:

The NRC staff's disposition of comments are individually addressed for each portion of the comment as follows:

- The NRC staff agreed with this comment. The staff reviewed all of the SRP-SLR Table I items that cited a plant-specific AMP. Where appropriate, specific GALL-SLR Report AMPs were cited. In some cases, this resulted in a change to the specific SRP-SLR further evaluation section to address the cited AMP. The technical basis for establishing the particular AMP is documented in the technical basis for the specific GALL-SLR Report line item.

  The NRC staff did not agree with this comment. The basis for the potential for loss of material for aluminum components exposed to any air environment (including indoor air environments) or condensation is the same as for cracking due to SCC of aluminum components exposed to any air environment or condensation. Leakage from bolted flanges and valve packing, even in accessible areas, facilitates the delivery of halogens to the component's surface, and could result in a wetted condition sufficiently long to result in loss of material.

  Even though the review of plant-specific OE might not reveal any instances of loss of material, the staff has concluded that the conduct of a one-time inspection is appropriate. One-time inspections are conducted to confirm that an aging effect is not occurring or it is occurring so slowly that the aging effect will not impact the component's intended function throughout the subsequent period of extended operation.

  A portion of the comment states, "[d]elete reference to a one-time inspection." This statement is made in relation to the results of the plant-specific OE review demonstrating that loss of material has occurred. The NRC staff agreed that if the plant-specific OE results reveal a history of loss of material, then a one-time inspection would not be performed, because a periodic inspection program, as cited in the FE section would be implemented in lieu of AMP XI.M32, "One-Time Inspection." This intent was made clearer by the SRP-SLR Table 1 and GALL-SLR Report items changed to reflect specific potential appropriate programs.

  The NRC staff did not agree with this comment. The staff has concluded that it is not appropriate to establish an item citing no aging effect and no recommended AMP for aluminum exposed to any air environment or condensation. The staff has concluded that a plant-specific OE search and at least a one-time inspection are necessary to demonstrate that loss of material is not an applicable aging effect for aluminum components exposed to any air environment or condensation. As a result, there would always be an applicable AMP for this material and environment combination.

Source 015

<u>Comment</u>: **<u>006</u>**

Location of Change

SRP FE

3.2.2.2.2
3.2.2.2.5
3.3.2.2.3
3.3.2.2.4
3.4.2.2.2

Description of Change

New Further Evaluation topics for stainless steel address cracking in outdoor air, or in any air environment when the component is insulated or where the component is in the vicinity of insulated components, or in close proximity to intake vents. Recommendations:

- Revise text describing the sources of aggressive environments as shown in the marked-up FE text. Address confirmation of the absence of cracking in indoor locations by plant OE review, similar to that of aluminum in indoor air.

- Delete text describing leakage of threaded or bolted connections as a source of water that supports aging.

- Delete text discussing use of a coating as a barrier to aggressive environments. Applicants have typically stated that coatings are not credited in this way, and the recommendation to monitor the coatings with the M42 coating program is not supported by the AMP text.

- Delete the environment "Moist air" from the definitions in section IX.D, and replace with "Condensation" wherever it occurs in the tables. Condensation environment should be specified when air is moist.

<u>SLR Supplement Related</u>

Justification For Change

- Stainless steel is not susceptible to loss of material or cracking in indoor air environments in which wetting is not expected (i.e., other than a condensation environment).
  EPRI 1010639 (Mech Tools) specifies that stainless steel is potentially susceptible to cracking when the surface is buried or exposed to a concentration of contaminants, or is exposed to an aggressive environment in outdoor locations. A concentration of contaminants is considered to be present when "*prolonged or frequent wetting (e.g., from condensation, leakage, ponding/pooling) or alternate wetting and drying can concentrate contaminants from the atmosphere and they can thereby become aggressive species for metals. Infrequent or intermittent wetting (e.g., limited time periods with condensation) are not expected to concentrate contaminants sufficiently to become aggressive for metals.*"

  Further evaluation Section 3.2.2.2.2 asserts that these aging effects are applicable in outdoor air, or in any air environment when the component is insulated or where the component is in the vicinity of insulated components, or in close proximity to intake vents. These are applicable aging effects in outdoor air, and in potentially wetted environments, but they are not expected within indoor locations for components at or above ambient temperature. Insulated or uninsulated components below indoor ambient temperature are assigned a condensation environment, and stainless steel exposed to condensation should be considered susceptible to pitting and crevice corrosion regardless of the presence of insulation, unless the absence of atmospheric contaminants can be demonstrated.

The FE sections recommend that leakage of fluids from mechanical connections, such as bolted flanges and valve packing, through insulation onto a component in indoor controlled air is identified as a water source that should be considered. However, in accessible areas, leakage does not result in a long-term wetted environment to be evaluated for aging. Leakage is an event, and does not represent a long-term environment that causes aging. Identified leakage and its effects are addressed through the corrective action program. It is appropriate to consider underground environments as potentially aggressive.

It's unlikely that applicants would credit a coating to provide a barrier to an aggressive environment for these components. If an applicant chose to do so, it would require a note E for a different program either with or without this text. Additionally, the XI.M42 program scope is clearly defined to be internal coatings. Use of this program to manage external coatings may be interpreted as a program exception.

Normal indoor air environments (Air-indoor uncontrolled, Air-indoor controlled) do not support wetting that would be expected to cause loss of cracking of stainless steel, as confirmed by the GALL IX.F definition of these environments (wetting is not normally expected). If conditions may result in wetting (e.g., moist air), "Condensation" should be specified and loss of material would be expected.

The definition of Air-indoor uncontrolled in GALL section IX specifies that the equipment surfaces are normally dry. Similarly, the air-indoor controlled environment is expected to have a lower dewpoint than air-indoor uncontrolled, and surfaces that may be wetted would be assigned the condensation environment.

RESPONSE:

The NRC staff's disposition of comments are individually addressed for each portion of the comment as follows:

- The NRC staff partially agreed with this comment. In lieu of adopting the changes as submitted by the industry, the changes are shown in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document. The further evaluation sections for managing loss of material and cracking for stainless steel (SS) components exposed to any air environment and condensation were revised to incorporate a review of plant-specific OE and a one-time inspection. Depending on the results of the OE review and one-time inspection, a periodic program might be appropriate. The staff concluded that the SRP-LR Revision 2 applicability criteria for these further evaluation sections (e.g., component located within approximately 5 miles of a saltwater coastline or ½ mile of a highway, which is treated with salt in the wintertime) may not account for all relevant factors. For example, depending on prevailing winds, the effects of coastal saltwater could be impactful beyond

5 miles. The staff concluded that a one-time inspection of SS components prior to entry in the subsequent period of extended operation coupled with a search of plant-specific OE related to loss of material of SS components would provide sufficient input to determine whether periodic inspections should be conducted.

Even though the review of plant-specific OE might not reveal any instances of loss of material, the staff has concluded that the conduct of a one-time inspection is appropriate. One-time inspections are conducted to confirm that an aging effect is not occurring or it is occurring so slowly that the aging effect will not impact the component's intended function throughout the subsequent period of extended operation.

See the NRC staff's response to part No. 2 of this comment for a discussion on the potential for wetting.

- The NRC staff did not agree with this comment. The basis for the potential for cracking for SS components exposed to any air environment (including indoor-air environments) or condensation is the same as for cracking due to SCC of aluminum components exposed to any air environment or condensation. Leakage from bolted flanges and valve packing, even in accessible areas, if it facilitates the delivery of halogens to the component's surface, could result in a wetted condition sufficiently long to result in cracking.

  To reinforce the potential for indoor-air environments providing adequate sources of moisture to cause SCC, the staff cites a licensee event report (LER) issued in December 2006 (ADAMS Accession No. ML063530355). Cracking and through wall leakage occurred in a SS standby liquid control tank due to the presence of leachable halogens in the grout at the base of the tank. The licensee stated that, "[i]n this case, the source of moisture was occasional condensation from above when the SLC tank lid was removed." The staff considers the removal and reinstallation of the tank's lid as a normal evolution and therefore the source of moisture is not considered event driven.

- The NRC staff did not agree with this comment. The staff has concluded that it will not eliminate GALL-SLR AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," as a potential AMP to manage aging effects associated with SS components exposed to any air environment or condensation. In accordance with the industry's Comment 015-055 Part No. 1, the staff is establishing GALL-SLR AMR items citing the various acceptable programs as cited in the further evaluation sections. As a result, AMP XI.M42 could be cited as a consistent AMP and generic note E would not need to be cited or justified. In regard to AMP XI.M42 being associated with internal coatings, the further evaluation sections (e.g., Section 3.2.2.2.13) states, "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 for internal or external coatings."

- The NRC staff agreed with this comment. The staff verified that all AMR items that cite "moist air" also cite "condensation." There are 33 GALL-SLR Report AMR items, affecting only Chapters V, VII, and VIII. All items cite loss of material or cracking and all cite an AMP to manage the aging effect. Citing condensation in lieu of moist air is sufficient because GALL-SLR Chapter IXD, "Use of Terms for Environments," states that condensation facilitates loss of material and cracking due to the moisture in the air.

Comment: 007

Location of Change

SRP FE

3.1.2.2.19
3.2.2.2.12
3.3.2.2.12
3.4.2.2.9

SRP Tables

3.2-1, 85
3.3-1, 29
3.3-1, 125
3.3-1, 203
3.4-1, 83
3.4-1, 85

GALL AMR rows

V.A.E-428	VII.A4.AP-110	VIII.C.SP-87	VIII.F.SP-81
V.D1.E-428	VII.A4.AP-111	VIII.D1.SP-87	VIII.F.SP-87
V.D2.E-428	VII.E1.A-88	VIII.D2.SP-87	VIII.G.SP-162
VII.A2.A-98	VII.E1.AP-79	VIII.E.SP-162	VIII.G.SP-87
VII.A2.A-99	VII.E3.AP-110	VIII.E.SP-80	
VII.A2.AP-79	VII.E4.AP-110	VIII.E.SP-81	
VII.A3.AP-79	VIII.B1.SP-87	VIII.E.SP-87	

Description of Change

Numerous GALL rows for stainless steel and nickel in treated water environments specify "Plant-specific aging management program," and link to Further Evaluation sections that describes which programs are acceptable for use. Use of these rows will require note E in Table 2s.

There are 25 of these new rows in GALL. Chapter V.A, V.C, V.D1 and V.D2 contain 4 rows that recommend XI.M2 and XI.M32, and chapter VII.A4 contains one row pointing to these traditional programs. GALL chapter VIII has no rows that recommend use of the XI.M2 and XI.M32 programs for loss of material of stainless steel in treated water.

Delete these Further Evaluation topics and revise/restore rows for stainless steel and nickel alloy in various treated water environments to recommend management by XI.M2 (Water Chemistry) and XI.M32 (One-Time Inspection). This recommendation is expected to provide appropriate aging management while supporting more efficient LRA review, as note E will not need to be used.

Source 015

Justification For Change

Stainless steel in treated water has the potential for loss of material when the halide or sulfate levels identified in these further evaluation topics are exceeded. However, these contaminant concentrations are not expected in treated water. The aging effects are managed by exclusion of these contaminants by use of the XI.M2 Water Chemistry program. For operation in the first PEO, the effectiveness of the Water Chemistry program was verified by the One-Time Inspection program. For material/environment combinations that were found to have aging effects present, corrective actions were taken or an ongoing aging management program would be required.

For oxygen concentrations >100 ppb, pitting corrosion is not expected in the absence of chlorides, fluorides or sulfates. Crevice corrosion may occur, but is expected to progress very slowly such that unacceptable degradation will not occur and can be managed with the XI.M2 Water Chemistry and XI.M32 One-Time Inspection programs. Operating experience with the One-Time Inspection program confirms that loss of material for stainless steel in treated water environments is not expected to challenge component function, or corrective actions (with the potential for plant-specific programs) would have been initiated during the first PEO. Note that the intent of LR-ISG 2011-01 that addressed loss of material for stainless steel in oxygenated treated borated water (and which many of these new rows address) was that the effectiveness of XI.M2 Water Chemistry (previously recommended by itself) should be confirmed by use of the XI.M32 One-Time Inspection program, not that a different program be used.

Similarly, water controlled by the XI.M2 Water Chemistry program is not expected to contain microbiological agents that could cause MIC. Unless identified by plant OE (including the completed One-Time Inspections), MIC is not expected to challenge the function of stainless steel components in treated water.

For each of the potential aging mechanisms discussed in the Further Evaluations, the XI.M2 (Water Chemistry) and XI.M32 (One-Time Inspection) program provide adequate aging management. Therefore, there is no need for further evaluation. Any degradation noted during the initial or second PEO by One-Time Inspection would drive evaluations for corrective action that could include an ongoing program.

Note that 3.1.2.2.19 is associated with GALL chapter IV, but there are no SRP Table 3.1-1 rows that link to this FE, and there are no associated GALL IV AMR rows.

This recommendation is expected to result in better and more consistent aging management and improved review efficiency, as evaluation of a plant-specific AMP as identified by a Table 2 note E will not be required.

RESPONSE:

The NRC staff agreed with this comment.

SRP-SLR Further Evaluation Sections 3.1.2.2.19, 3.2.2.2.12, 3.3.2.2.12, 3.4.2.2.9, 3.1.3.2.19, 3.2.3.2.12, 3.3.3.2.12, and 3.4.3.2.9 were deleted. The associated items were revised to cite AMP XI.M2, “Water Chemistry,” and AMP XI.M32, “One-Time Inspection.” The basis is as follows:

- Oxygen levels and contaminants are controlled by AMP XI.M2, “Water Chemistry.”

- The revised items already or will additionally cite that a one-time inspection should be conducted in accordance with AMP XI.M32. The NRC staff added AMP XI.M32 to some items because although the aging effect is not expected to occur, the purpose of AMP XI.M32, in part is to recommend inspections that confirm that an aging effect is not occurring.

- The Acceptance Criteria program element of AMP XI.M32 recommends two tiers of acceptance, the first for individual results and the second for projected degradation results of each material, environment, and aging effect combination. The criteria for the projected degradation results are: (a) affect the intended function of a system, structure, or component; (b) result in a potential leak; or (c) result in heat transfer rates below that required by the current licensing basis to meet design limits. The Corrective Action program element states, "[w]here an aging effect identified during an inspection does not meet acceptance criteria or projected results of the inspections of a material, environment, and aging effect combination do not meet the above acceptance criteria, a periodic inspection program is developed for the specific material, environment, and aging effect combination." As a result, any indications that either fail the acceptance criteria at the time of inspection or when projected degradation results do not meet the acceptance criteria described above, a periodic program is developed.

- The Detection of Aging Effects program element of AMP XI.M32 recommends that the one-time inspections be conducted no earlier than 10 years prior to the subsequent period of extended operation.

In summary, the recommended acceptance criteria and corrective actions in AMP XI.M32 will result in the development of a periodic program if pitting or crevice corrosion is detected and there is sufficient enough progression of the aging mechanism to pose a potential challenge to a component's intended function prior to the end of the subsequent period of extended operation. As a result, AMP XI.M32, as written, already embodies sufficient guidance to result in the proposed further evaluation section being moot. The staff provides clarification to a portion of the industry's comment, "[a]ny degradation noted during the initial or second period of extended operation by One-Time Inspection would drive evaluations for corrective action that <u>could</u> include an ongoing program." Based on the wording of the Corrective Action program element, a periodic program would not be required only if the observed degradation is such that based on a projection of the observed degradation, all components in the material, environment, and aging effect combination will meet acceptance criteria at the end of the subsequent period of extended operation.

In conjunction with evaluating this comment, the staff reviewed other further evaluation sections in the SRP-SLR. The staff concluded that the SRP-SLR Further Evaluation Sections 3.1.2.2.16 Part (2), 3.1.2.2.17, 3.2.2.2.9, 3.3.2.2.9, 3.1.3.2.17, 3.2.3.2.9, and 3.3.3.2.9 will also be deleted based on a change to AMP XI.M7, "BWR Stress Corrosion Cracking," as described below. These further evaluation sections were proposed based upon the deletion of AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle." The scope of AMP XI.M7, "BWR Stress Corrosion Cracking," was revised to state that, control rod drive return line nozzle caps and associated welds may be included in the scope of the program. The new further evaluation sections cited AMP XI.M2 and AMP XI.M7 to manage cracking due to SCC or IGSCC. The new further evaluation sections were proposed to ensure that applicants addressed the effects of cracking in dead legs and other piping locations with stagnant flow associated with control rod return line components. The sections state that the purpose of the further evaluation is to ensure that these locations are identified 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. The review section of the further evaluation (Sections 3.1.3.2.17, 3.2.3.2.9, and 3.3.3.2.9) state that the reviewer ensures that the applicant has identified any such locations and provided justification for the AMPs credited for managing this aging effect.

The staff eliminated the cited further evaluation sections by modifying the “detection of aging effects” program element of AMP XI.M7 to incorporate guidance (related to stagnant flow locations) from BWRVIP-75-A, “BWR Vessel and Internals Project Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules.” Table 3-1, “Summary of Changes,” of this document, Footnote 3b states, “[d]uring the selection of locations for inspection, consideration should be given regarding locations where IGSCC could be accelerated by crevice corrosion or thermal fatigue. In addition, locations having attributes that would promote IGSCC should have higher priority for inspection. The attributes that may be considered include: high carbon or low ferrite content, crevice or stagnant flow condition, evidence of weld repair, surface cold work, and high fit-up, residual and operating stresses.” Generic Letter 88-01, Supplement 1, “NRC Position on Intergranular Stress Corrosion Cracking (IGSCC) in BWR Austenitic Stainless Steel Piping,” does not address stagnant flow or dead leg locations. The program element was revised to state that the potential for stagnant flow conditions such as dead legs is considered when selecting inspection locations. The Detection of Aging Effects program element also states that the program identifies these locations. The staff concluded that, as revised, there is sufficient direction in AMP to provide reasonable assurance that the locations most susceptible to SCC and IGSCC will be inspected.

The following AMR items cited these further evaluations. The changes to the AMR items are as follows.

- IV.A1.R-411 (SRP-SLR item 3.1.1-130) was deleted.

- IV.A1.R-412, IV.C1.R-20, and IV.C1.R-21 (SRP-SLR item 3.1.1-097) no longer cites a further evaluation.

- V.D2.E-37 (SRP-SLR item 3.2.1-054) no longer cites a further evaluation. [SRP-SLR item 3.2.1-66, E-400 erroneously cite this FE section, the correct reference is Section 3.2.2.2.7]

- VII.E4.A-61 (SRP-SLR item 3.3.1-110) no longer cites a further evaluation.

<u>Comment</u>: <u>008</u>

Location of Change

SRP Tables

3.3-1, 164
3.3-1, 165

GALL AMR rows

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
VII.I.A-455

Description of Change

Nine new rows were added to GALL-SLR section VII for management of loss of material due to causes other than selective leaching for gray cast iron in various environments. All of the new rows recommend either M36 or M38 programs.

Consider deleting these rows.

Justification For Change

The same aging effects for steel in treated water are managed by M2 and M32, for raw water by M20 (Open cycle) or M27 (Fire Water), for waste water by M36 or M38, and for air environments by various programs including M36 or M38. Non-SL aging of gray cast irons would be appropriately managed by these programs. As described in the IX.C definitions, and as established by past use, applicants may simply align the GCI components to GALL rows for steel to address these other loss of material mechanisms. These rows do not appear to provide any additional flexibility or different guidance, and are present only within GALL Chapter VII.

RESPONSE:

The NRC staff agreed with this comment and associated changes to the GALL-SLR Report have been made. The change was incorporated as requested.

GALL-SLR Report items A-455 and A-456, as well as SRP-SLR AMR items 3.3-1, 164 and 3.3-1, 165 had been deleted in the SRP-SLR Supplemental Staff Guidance document. Deleting the items is consistent with GALL Report Chapter IX.C., "Use of Terms for Materials." The use of the term "gray cast iron" states in part, "[g]ray cast iron is susceptible to selective leaching, resulting in a significant reduction of the material's strength due to the loss of iron from the microstructure, leaving a porous matrix of graphite. In some environments, gray cast iron is categorized with the group 'Steel." Gray cast iron components are addressed as "steel" for aging effects, such as loss of material due to general, pitting, crevice corrosion, and microbiologically influenced corrosion (MIC). Gray cast iron is uniquely identified as the applicable material when addressing selective leaching.

The staff verified the following:

There are AMR items (e.g., A-722, E-29, AP-280, SP-136, AP-281) for steel piping and piping components exposed to outdoor air, indoor uncontrolled air, condensation, raw water, and waste water being managed for loss of material due to general, pitting, crevice corrosion and MIC (raw water and waste water only) by AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." Gray cast iron components would be covered by these items.

Source 015

There are AMR items (e.g., EP-60, AP-106, SP-74) for steel piping and piping components exposed to treated water being managed for loss of material due to general, pitting, crevice corrosion and MIC by AMP XI.M2, “Water Chemistry,” and AMP XI.M32, “One-Time Inspection.” Gray cast iron components would be covered by these items.

Stainless steel components exposed to treated water (or treated borated water) greater than 60 degrees C [140 degrees F] are treated similarly. Cracking due to stress corrosion cracking becomes an applicable aging effect when temperatures exceed 60 degrees C [140 degrees F]. All of the AMR items (e.g., RP-231, EP-98, A-56, SP-85) for stainless steel components exposed to treated water greater than 60 degrees C [140 degrees F] only address cracking due to stress corrosion cracking as an aging effect. Other items (e.g., EP-73, AP-110, SP-87) where the temperature is not specified as being greater than 60 degrees C [140 degrees F] address loss of material due to pitting and crevice corrosion.

Comment: 009

Location of Change

SRP FE

3.3.2.2.8

SRP Table

3.3-1, 172

GALL AMR Rows

VII.C1.A-458
VII.E5.A-458
VII.G.A-458

Description of Change

Three new GALL-SLR rows address aging of PVC in “Sunlight” environment by use of a plant-specific program. Recommend:

- Revise environment to “Air–outdoor” and
- Recommend management by the XI.M36 “External Surfaces Monitoring” program. With this program assignment, the FE text may be deleted.

Justification For Change

- This environment is not defined, and would apply only to this material. The addition of these rows is a benefit, as they provide recommendations for an aging effect that industry has previously identified, but was not previously addressed in GALL. However, sunlight is only expected in (some) outdoor environments, and there is no GALL row that corresponds to an outdoor air environment that is shaded (e.g., in a manhole, or under some open-air structure) and does not exhibit aging effects. Without the addition of an air-outdoor line that does not support the aging effect, simply calling this environment air-outdoor is conservative, and fills a gap in the environments addressed for PVC.

_ The XI.M36 “External Surfaces Monitoring” program is normally recommended for external surfaces that aren’t specifically addressed by another program. The naming of aging effects for polymers varies according to the references cited: EPRI 1010639 (Mechanical Tools) refers to “loss of strength,” which corresponds to the XI.M36 “changes in material properties (such as hardening and loss of strength)” and to “reduction in impact strength.” EPRI 1007933 (Aging Assessment Field Guide) identifies several types of UV degradation of elastomers and polymers. UV degradation that results in “reduced strength, spontaneous fracture” (corresponding to reduction in impact strength) is normally accompanied by visible indications of age related degradation, such as yellowing or other discoloration, chalking, and surface crazing. XI.M36 addresses aging of polymers and is an appropriate program for management of aging of PVC external surfaces. If this program is recommended, no further evaluation would be needed.

This recommendation is expected to result in better and more consistent aging management and improved review efficiency, as evaluation of a plant-specific AMP as identified by a Table 2 note E will not be required.

RESPONSE:

The NRC staff agreed with this comment. The change was incorporated as requested.

The aging effect addressed in this further evaluation is reduction of strength due to photolysis. This is based on the staff’s review of JM Eagle™ Technical Bulletin, “The Effects of Sunlight Exposure on PVC Pipe and Conduit,” JM Manufacturing Company Inc., January 2009, “[l]ong-term (2 years or longer) exposure of PVC piping, piping components, and piping elements to sunlight can result in a reduction in impact strength.” The staff used the term “sunlight” to limit the applicability of the AMR item to the actual environment that results in the aging effect. As stated by the comment, citing the outdoor air is conservative.

The NRC staff also agreed with the portion of the comment recommending that AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” be cited in lieu of a plant-specific AMP and the further evaluation be deleted. The Parameters Monitored and Inspected program element of AMP XI.M36 recommends that visual examinations of elastomeric and flexible polymeric materials be augmented with manual or physical manipulation of the material. Manual or physical manipulation of the material includes touching, pressing on, flexing, bending, or otherwise manually interacting with the material. The purpose of the manual manipulation is to reveal changes in material properties, such as hardness, and to make the visual examination process more effective in identifying aging effects such as cracking.

In order to provide clarity on the recommendation associated with this material, environment, and aging effect combination, the “parameters monitored and inspected” program element of AMP XI.M36 was revised to recommend flexing and bending of polyvinyl chloride (PVC) piping exposed directly to sunlight (i.e., not located in a structure restricting access to sunlight such as manholes, enclosures, and vaults or isolated from the environment by coatings) to detect indications of the potential for reduction of impact strength such as a crackling sound when flexed or surface cracks.

Source 015

Comment: 010

Location of Change

SRP FE

3.1.2.2.15
SRP Table
3.1-1, 127

GALL AMR rows

IV.D1.R-436
IV.D2.R-440

Description of Change

New GALL rows address loss of material due to boric acid corrosion for steel with stainless steel or nickel alloy cladding SG heads exposed to reactor coolant. An associated Further Evaluation topic describes foreign OE about an area of missing cladding that allowed boric acid attack during shutdown.

Recommend deleting these GALL rows, SRP row 3.1-1, 127, and FE 3.1.2.2.15.

Justification For Change

The OE referenced in FE 3.1.2.2.15 which forms the basis for these rows describes the consequences of a manufacturing defect, not an aging effect that is expected for steel with stainless or nickel alloy cladding.

Additionally, the potential for this degradation is adequately managed by AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and AMP XI.M2, "Water Chemistry" as recommended by IV.D1.RP-232 and IV.D2.RP-47, which address cracking of steel-with-stainless-steel-cladding SG primary components. Since these items are intended to ensure the integrity of the stainless steel cladding (inspections for cracking), they are also sufficient to ensure that any areas of missing cladding are identified and corrected. With management by the XI.M1 program, no further evaluation is needed.

A similar issue was identified at the Callaway plant where a cladding breach in the reactor vessel was identified during ASME Inservice Inspection of the reactor vessel. The Callaway license renewal SER (NUREG–2172, ML15068A342) section 3.0.3.1.4 (Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components) addressed the cladding breach and the adequacy of the associated aging management. RAI B2.1.5-4, B2.1.5-4a and B2.1.5-4b were issued requesting that the applicant describe the inspection methods and frequency of the subsequent inspections of the cladding indications as defined in the applicant's program and describe the technical basis for why the inspection method and frequency are adequate to manage the degradation of cladding and reactor vessel. The applicant provided details of the inspections and stated that they were consistent with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWB program. The staff reviewed the responses and found the applicant's response acceptable because the applicant clarified that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program will perform depth measurements of the indications using an examination method that is capable of measuring the depths, consistent with ASME Code Section XI.

This OE confirms the expectation that implementation of the ASME code inspections per the XI.M1 program is adequate to identify cladding breaches and establish appropriate corrective actions.

This recommendation is expected to result in better and more consistent aging management and improved review efficiency, as evaluation of a plant-specific AMP as identified by a Table 2 note E will not be required.

RESPONSE:

The staff partially agreed with this comment. SRP-SLR AMR item 3.1-1, 127, and the corresponding GALL-SLR Report AMR items IV.D1.R-436 and IV.D2.R-440 have been deleted.

Since receipt of the comments on these AMR items and the contents of the new further evaluation acceptance criteria guidance in SRP-SLR Section 3.1.2.2.15, the staff issued Interim Staff Guidance Document (ISG) No. LR-ISG 2016-01, “Changes to Aging Management Guidance for Various Steam Generator Components,” to the industry. The ISG includes updated augmented inspection recommendations for PWR steam generator channel head and tubesheet components, as implemented in accordance with an applicant’s AMP that corresponds to GALL-SLR Report AMP XI.M19, “Steam Generators.” Based on issuance of the updated guidance in LR-ISG-2016-01, the staff partially agreed that further evaluation, as evaluated in accordance with the guidance in SRP-SLR Section 3.1.2.2.15, would not need to be applied to use these AMR items. Therefore, the staff has deleted the draft versions of the further evaluation acceptance criteria in SRP-SLR Section 3.1.2.2.15, and the corresponding review procedures in SRP-SLR Section 3.1.3.2.15. Instead, the staff reformatted Sections 3.1.2.2.15 and 3.1.3.2.15 to contain the staff’s further evaluation acceptance criteria and review procedures guidance for managing loss of material and cracking in steel piping and piping exposed to concrete.

However, based on issuance of LR-ISG-2016-01, the staff’s perspective is the programs in GALL-SLR AMP XI.M19, “Steam Generators,” and GALL-SLR AMP XI.M2, “Water Chemistry,” remain as valid AMPs that may be used to manage any loss of material that may occur in these components as a result of boric acid corrosion. Thus, while the staff agreed the further evaluation of the aging effect and mechanism would be unnecessary for a PWR subsequent license renewal applications, the applicable AMR items will continue to identify that AMP XI.M19 is the appropriate AMP for performing inspections of the steam generator channel head and tubesheet components, and that AMP XI.M2 is appropriate for controlling the concentrations of reactor coolant additives and impurities that, if otherwise left uncontrolled could potentially induce boric acid corrosion of the components. As always, a PWR subsequent license renewal applicant using these AMR items may be justified in using of their inservice inspection program (i.e., the AMP that corresponds to the program in GALL-SLR Report AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD”) as an alternative condition monitoring program basis for the components. Consistent with the guidance in Nuclear Energy Institute (NEI) Report No. 17-01, the alternative AMR basis for using the inservice inspection (ISI) program as an alternative AMP would be identified in the applicable SLRA AMR table using NEI 17-01, Generic AMR Note E, and any plant-specific AMR footnotes that may need to be associated with the AMR items.

Source 015

<u>Comment</u>: **<u>011</u>**

Location of Change

SRP Tables

3.1-1, 69
3.1-1, 125

GALL AMR rows

IV.D1.R-47
IV.D1.R-48
IV.D1.R-437
IV.D2.R-47
IV.D2.R-48
IV.D2.R-442

Description of Change

New GALL rows address cracking of SG tubes at tube support plate locations due to flow-induced vibration or high-cycle fatigue.

Recommend combining all cracking mechanisms (R47, R-48 and R-437/R-442) for the external surfaces of the SG tubes into one IV.D1 row and one IV.D2 row. See markup.

Justification For Change

These rows are redundant, as the aging effect (cracking) is managed over the entire tube length with the same programs that are recommended by this row via R-47 & R-48. Citing multiple GALL rows for the same component, material, environment, aging effect, and programs does not add value, may result in a confusing Table 2 presentation, and may be difficult to implement with some LR databases.

RESPONSE:

The staff partially agreed with this comment and the proposed changes to the AMR items referenced in the comment.

The comment recommended that SRP-SLR AMR item 3.1-1, 069 should be consolidated with AMR item 3.1-1, 125, which pertains to management of cracking in steam generator tubes (at tube support plate locations) that is induced by flow-induced vibrations or vibrational fatigue. Similarly, the comment recommends that that the GALL-SLR Report AMR items IV.D1.R-47, IV.D1.R-48, and new item IV.D1.R-437, should be consolidated into a single item IV.D1.R-48. In addition, it recommends that AMR items IV.D2.R-47, IV.D2.R-48, and new item IV.D2.R-442 should be consolidated into a single version of item IV.D2.R-48; all with AMP XI.M19, “Steam Generators,” and AMP XI.M2, “Water Chemistry,” being cited for managing cracking in the components.

For recirculating steam generator designs, the staff partially agreed with the commenter’s recommendation to consolidate the AMR items. Specifically, the existing items in SRP-SLR item 3.1-1, 069, and the collective basis in AMR items IV.D1.R-47 and IV.D1.R-48, pertain to the management of cracking in nickel alloy recirculating generator tubes and sleeves that are induced by corrosive or chemically related aging mechanisms. These include outer diameter stress corrosion cracking as the mechanism that applies in item IV.D1.R-47, and intergranular attack being the aging mechanism that applies to item IV.D1.R-48. For once-through steam generator designs, the analogous items are items IV.D2.R-47 and IV.D2.R-48. All of these AMR items cite use of AMP XI.M19 and AMP XI.M2, for managing cracking that is induced by one of these corrosive mechanisms. Thus, for these items, the staff agreed to delete AMR items IV.D1.R-48 and IV.D2.R-48 because, consistent with the comment recommendation, the staff found it appropriate to add intergranular attack as an additional aging mechanism that is listed in items IV.D1.R-47 and IV.D2.R-47. SRP-SLR item 3.1-1, 069, was adjusted accordingly.

The staff did not agree that the bases of new AMR item IV.D1.R-437 could be consolidated into a modified version of item IV.D1.R-47, or that item IV.D2.R-437 could be consolidated in a modified version of item IV.D2.R-47, such that new AMR items IV.D1.R-437 and IV.D2.R-437 could be deleted. Specifically, bases of the new items apply to cracking that is induced by mechanical aging mechanisms, such as vibrational fatigue or flow-induced vibration. Thus, AMP XI.M2, cannot be applied to these new AMR items because it is only valid for managing aging effects that are induced by chemistry related or corrosive aging mechanisms. Use of AMP XI.M2 does not apply to aging effects that are induced by mechanical aging mechanisms. Therefore, AMP XI.M19 is the proper AMP to reference for managing cracking due to flow-induced vibrations or vibrational fatigue in regions of recirculating steam generator tubes that are located at tube support locations.

Comment: 012

Location of Change

SRP Tables

3.3-1, 156
3.3-1, 173
3.4-1, 33
3.4-1, 92

GALL AMR rows

VII.H1.A-660
VII.H1.A-667
VIII.E.S-439
VIII.E.S-440
VIII.F.S-439
VIII.F.S-440
VIII.G.S-439
VIII.G.S-440

Source 015

Description of Change

VII.H1.A-660 and VII.H1.A-667 are adjacent in table VII.H1 and appear to be redundant (exactly the same table entries, but with different SRP links). Similarly, S-439 and S-440 appear to be redundant, appearing in VIII.E, VII.F and VIII.G.

Recommend deleting redundant rows.

Justification For Change

Identical entries for A-660 (3.3-1, 156) and A-667 (3.3-1, 173), with minor differences in the Table 1 wording. The Table 1 items are used for multiple other GALL rows.

Identical entries for S-439 (3.4-1, 92) and S-440 (3.4-1, 33) with differences in the Table 1 environments (both include the environments in S-439 and S-440).

A-667 is used in VII.H2 without A-660, so deleting A-660 will eliminate duplicate entry without losing needed row in VII.H1.

S-439 is used without S-440 in VIII.D1 and VIII.D2, so deleting S-440 will eliminate duplicates without losing needed rows in VIII.D1 and VIII.D2.

RESPONSE:

The NRC staff agreed with this comment and changes were incorporated as described below.

AMR items A-667 and A-660 were duplicates. The staff deleted A-667 in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document. Similarly, S-439 and S-440 were duplicates and S-440 was deleted in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document.

Comment: **013**

Location of Change

SRP Table

3.2-1, 73
3.3-1, 139
3.4-1, 67

GALL AMR rows

V.A.E-414	VII.A4.A-414	VII.E3.A-414	VII.G.A-414	VIII.D1.S-414
V.B.E-414	VII.C1.A-414	VII.E4.A-414	VII.H1.A-414	VIII.D2.S-414
V.C.E-414	VII.C2.A-414	VII.E5.A-414	VII.H2.A-414	VIII.E.S-414
V.D1.E-414	VII.C3.A-414	VII.F1.A-414	VIII.A.S-414	VIII.F.S-414
V.D2.E-414	VII.D.A-414	VII.F2.A-414	VIII.B1.S-414	VIII.G.S-414
VII.A2.A-414	VII.E1.A-414	VII.F3.A-414	VIII.B2.S-414	
VII.A3.A-414	VII.E2.A-414	VII.F4.A-414	VIII.C.S-414	

Description of Change

Modified GALL rows for management of “Any material with an internal coating/lining” and a variety of fluid environments now list cracking due to stress corrosion cracking as an aging effect.

Recommend deletion of cracking from these GALL rows.

Justification For Change

Cracking was not previously listed as an aging effect for components with an internal coating. Cracking within internal fluid environments is not expected for metals other than stainless steel, and is not expected for stainless steel at temperatures below 140 degrees F. Most coatings/linings are made of a polymeric material, and would not normally be used in applications at higher temperatures. Therefore, it’s very unlikely that an applicant will find cracking to be an applicable aging effect for internally coated components. With cracking listed in GALL as an aging effect for any material with an internal coating, and in many fluid environments, these rows have the potential to add confusion and review burden. Most applicants will probably not list cracking as an aging effect when citing these rows in AMR Table 2s. Reviewers may be compelled to question the absence of this aging effect when applicants claim consistency with these line items.

This change is intended to reduce confusion and improve review efficiencies.

RESPONSE:

The NRC staff agreed with this comment and the change was incorporated as requested.

The original intent in revising these items to include cracking due to SCC was to minimize the potential for citing items in a license renewal application that are not consistent with the GALL-SLR Report. With the evolving nature of polymeric coatings, it could be possible that in the next 20 to 30 years, coatings that would be effective in environments exceeding 60 degrees C [140 degrees F] might be used in commercial power plants. In addition, waste water (item 3.3.1-139) could contain deleterious materials that would result in cracking at temperatures below 60 degrees C [140 degrees F]. With deletion of the aging effect and aging mechanism, an applicant with this material, environment, and aging effect combination would identify this material, environment, and aging effect combination in its license renewal application (LRA) and cite it as not consistent.

Comment: **014**

Location of Change

SRP FE

3.3.2.2.12

SRP Table

3.3-1, 28

Source 015

<u>GALL AMR row</u>

VII.E1.AP-82

Description of Change

This GALL row was added to GALL R2 by LR-ISG-2011-01 to address the potential for cracking of stainless steel in treated borated water when oxygen concentration is controlled. It links to SRP Table 1 item 3.3-1, 28, which was not previously associated with a Further Evaluation topic. The modified AMR row now recommends management with a plant-specific program and links to Further Evaluation topic 3.3.2.2.12.

Consider restoring the temperature regime “>60 degrees C (>140 degrees F),” changing the program recommendation to AMP XI.M2, “Water Chemistry,” and AMP XI.M32, “One-Time Inspection,” and deleting the SRP 3.3-1, 28 reference to FE 3.3.2.2.12.

Justification For Change

This GALL row was added by LR-ISG-2011-01 to address the potential for cracking of stainless steel in treated borated water >140 degrees F with oxygen levels controlled, such that the potential for cracking could be managed by the XI.M2 “Water Chemistry” program alone (without use of XI.M32 “One-Time Inspection”).

The revision in SLR GALL removed both the temperature and oxygen regimes specification and replaced the program recommendation with a plant-specific program. Cracking is not expected in stainless steel with internal fluid environments controlled by water chemistry unless the temperature is >140 degrees F.

Management with the XI.M2 and XI.M32 programs has been effective, and is the preferred aging management recommendation for this material/environment/aging effect combination.

Further Evaluation topic 3.3.2.2.12 was linked to SRP Table 1 item 3.3-1, 28, but does not address cracking, so it is not applicable to 3.3-1, 28.

See also comment #7 for additional justification for specifying XI.M2 and XI.M32 in lieu of a plant-specific program.

This recommendation is expected to result in better and more consistent aging management and improved review efficiency, as evaluation of a plant-specific AMP as identified by a Table 2 note E will not be required.

RESPONSE:

The NRC staff agreed with this comment and the change was incorporated as requested.

The GALL-SLR and SRP-SLR Supplemental Staff Guidance document corrected SRP-SLR item 28 consistent with the comment: (a) the temperature limit, “>60 degrees C (>140 degrees F),” was restored to the environment description; (b) the AMP recommendation cites AMP XI.M2, “Water Chemistry” and AMP XI.M32, One-Time Inspection”; (c) MIC was deleted, and (d) the Further Evaluation Recommended column now cites “No.” These changes are consistent with the technical basis described in LR-ISG-2011-01, “Aging Management of Stainless Steel Structures and Components in Treated Borated Water, Revision 1." Nickel alloy was also added to the cited materials to be consistent with other similar line items in the GALL-SLR Report (e.g., RP-36, RP-40).

Comment: 015

Location of Change

SRP Table 3.4-1, 83

GALL AMR rows

VIII.E.SP-162
VIII.G.SP-162

Description of Change

Rows are for stainless steel tanks.

Delete "general (steel only)" from aging effect / mechanism column.

Justification For Change

Rows are for stainless steel only. Steel (and general corrosion) are not applicable to these rows.

Also see comment #7 for other recommendations associated with these lines (program recommendation, FE link).

RESPONSE:

The NRC staff agreed with this comment. The AMR items had been revised in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document. Stainless steel tanks are not affected by general corrosion in a treated water environment. See EPRI Report No. 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools," Revision 4, Figure 1, "Treated Water/Stainless Steel and Nickel-Base Alloys."

Comment: 016

Location of Change

SRP Table 3.1-1, 122

GALL AMR rows

IV.C1.R-429
IV.C2.R-429

Description of Change

These two new rows group steel, stainless steel, nickel alloy and copper alloys together, in environments of air-indoor, uncontrolled, and condensation, with Loss of material due to general (steel, copper alloy only), pitting, crevice corrosion.

Delete stainless steel, nickel alloy and copper alloy from the material list, delete "(steel, copper alloy only)" and delete condensation from the environment list.

Justification For Change

This row may imply to reviewers that stainless steel in indoor air is expected to be susceptible to loss of material due to pitting and crevice corrosion. EPRI 1010639 (Mech Tools) specifies that copper alloys are not susceptible to general corrosion except in fluid environments, and stainless steel, nickel alloys and copper alloys are potentially susceptible to loss of material due to pitting and crevice corrosion when the surface is buried or exposed to a concentration of contaminants, or is exposed to an aggressive environment in outdoor locations. A concentration of contaminants is considered to be present when "*prolonged or frequent wetting (e.g., from condensation, leakage, ponding/pooling) or alternate wetting and drying can concentrate contaminants from the atmosphere and they can thereby become aggressive species for metals. Infrequent or intermittent wetting (e.g., limited time periods with condensation) are not expected to concentrate contaminants sufficiently to become aggressive for metals.*" This environment is not expected within indoor air for components not exposed to condensation. See comment #6 for similar issue.

Only steel is susceptible to loss of material in air-indoor uncontrolled. GALL rows IV.C1.R-431 and IV.C2.R-431 (both linking to 3.1-1, 124) address loss of material for Steel; stainless steel, nickel alloy; copper alloy exposed to condensation. Therefore, these portions of IV.C1.R-429 and IV.C2.R-429 imply aging effects that are not applicable for some M/E combinations, and may potentially cause confusion and additional review burden.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The staff reviewed SRP-SLR Table 3.1-1 and concluded that items 122 and 124 overlapped in the cited material, environment, and aging effect program combination. As a result, item 122 (i.e., IV.C1.R-429, IV.C2.R-429) was deleted. Item 124 was revised to cite any air environment (except air-dry internal) and condensation. However, given the similarity of the two items, the comment remains the same.

<u>Stainless steel</u>: Stainless steel was deleted from item R-431 so that item R-431 did not have to cite a further evaluation section. A new line was generated in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document to address loss of material due to pitting and crevice corrosion for stainless steel components exposed to air, environment, and condensation. The new line item cites further evaluation Section 3.1.2.2.20. The basis for citing a further evaluation section for the new item is addressed in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document and response to industry comment Attachment 2, Comment No. 6.

<u>Nickel alloy</u>: The staff agreed with the industry's comment that nickel alloys are not susceptible to pitting and crevice corrosion unless exposed to a concentration of contaminants (EPRI 1010639, Table 4-1, "Aging Effects Summary-External Surfaces." Footnote 1 of this table states, "[p]rolonged or frequent wetting (e.g., from condensation, leakage, ponding/pooling) or alternate wetting and drying can concentrate contaminants from the atmosphere and they can thereby become aggressive species for metals. Infrequent or intermittent wetting (e.g., limited time periods with condensation) are not expected to concentrate contaminants sufficiently to become aggressive for metals." As discussed in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document, sources of moisture in plant areas include condensation and leakage from mechanical connections such as bolted flanges and valve packing. Insulation can contain

sufficient levels of halogens to promote pitting and crevice corrosion. The staff has concluded that nickel alloy materials are no more susceptible to loss of material due to pitting and crevice corrosion in air environments where moisture is possible than are stainless steel components. As a result, the staff has revised the further evaluation sections (i.e., 3.1.2.2.20, 3.2.2.2.2, 3.3.2.2.4, 3.4.2.2.3) to include nickel alloys. In lieu of the currently recommended periodic program (AMP XI.M36, "External Surfaces Monitoring of Mechanical Components") in item R-429, a one-time inspection is conducted. If the plant-specific search of OE and the one-time inspection demonstrate 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 during the subsequent period of extended operation, further inspections are not conducted.

As a result, the staff revised GALL-SLR items as follows:

Nickel alloy was deleted from item R-431, S-431, S-454, S-455, EP-123, E-433, 3.3.1-95 (AP-274), AP-284, 3.3.1-181 (A-701), A-702, SP-161, and S-455.

Nickel alloy was added to the following further evaluation sections: 3.1.2.2.20, 3.1.3.2.20, 3.2.2.2.2, 3.2.3.2.2, 3.3.2.2.4, 3.3.3.2.4, 3.4.2.2.3, and 3.4.3.2.3.

Nickel alloy was added to the following items: EP-61, EP-81, EP-107, E-442. E-449, E-450, E-455, AP-221, A-751, A-757, A-761, SP-127, S-425, S-441, S-443, S-446, and S-451.

Items RP-03, EP-17, AP-16, and SP-11 were deleted. These items stated that there are no aging effects requiring management and no recommended AMP for nickel alloy components exposed to air-indoor uncontrolled. The staff did not delete RP-378, EP-115, AP-260, and SP-148 because these items establish that there is no need to manage loss of material for nickel alloy components exposed specifically to borated water leakage.

Item A-701 was deleted because nickel alloy piping and piping components exposed to condensation was incorporated into AP-221.

<u>Copper alloy</u>: The NRC staff agreed with the industry comment that copper alloys are not susceptible to loss of material unless exposed to a water environment. The staff reviewed: (a) "Atmospheric Corrosion of Copper Alloys Exposed for 15 to 20 Years," L.P. Costos, ASTM International, 1982, which tested copper alloys in marine, industrial, and rural environments; and (b) "General Localized and Stress Corrosion Resistance of Copper Alloys in Natural Atmospheres," A.P. Castillo, ASTM International, 1982, which tested copper alloys in urban industrial (with some sea salt and road salt) and heavy industrial (with ammonia and sulfur dioxide) environments. The general loss of material rates (pitting was not a factor) ranged from 0.009 mils per year (mpy) to 0.09 mpy and 0.12 mpy to 0.14 mpy (in the latter study). These environments envelope what would be expected in a nuclear power plant air environment and the loss of material rates would not be expected to challenge the intended function of a copper alloy component. In contrast, the staff reviewed "Aluminum Bronzes-Part I, Metallurgy of Copper and Copper Alloys," Vin Collcut, Copper Development Association Inc. Innovations Publications August 2002. Table 5 of this document, "Resistance to General Corrosion, Crevice Corrosion, and Corrosion-Erosion in Flowing Seawater," listed loss of material rates of 1.6 mpy for 90/10 copper nickel, and 0.9 mpy for 70/30 copper nickel, and 2 mpy for 8 percent aluminum bronze components. This study confirms that aging effects associated with copper alloys exposed to water should be managed while exposure to air environments and condensation, are not consequential.

As a result, the staff revised GALL-SLR Report items as follows:

Copper alloy was deleted from R-431, E-403, E-433, AP-284, A-405, S-402, S-431, S-454, S-455, SP-161, AP-143, and A-637.

Items AP-109, AP-159, and AP-240 were deleted.

The condensation environment was removed from item 3.3.1-95. This resulted in the deletion of items AP-273 (Stainless steel, GALL-SLR and SRP-SLR Supplemental Staff Guidance document), AP-274 (nickel alloy), and AP-280 (steel). Stainless steel and nickel alloy components exposed to condensation are covered by further evaluation items. Steel components exposed to condensation are covered by 3.3-1, items 095, 128, 129, and 220. Removing the condensation environment left only the waste water environment, which can result in loss of material for copper alloy, nickel alloy, and steel.

The items associated with 3.3.1-114 and 3.4.1-54 were revised to state that there are no aging effects for copper alloy piping and piping components exposed to any air environment, condensation, and gas. New AMR items were generated for Chapter IV and V.

Comment: 017

Location of Change

SRP Tables

3.2-1, 99
3.2-1, 106
V.D1.E-449,
V.D2.E-449
V.E.E-442

Description of Change

Multiple GALL R2 rows for loss of material for tanks of various metals in outdoor air environments, managed with M29 (Aboveground tanks) were changed or deleted and replaced with new rows for stainless steel.

Recommend adding aluminum material to the rows at left.

Justification For Change

There are no longer any rows for tanks/aluminum/outdoor air environments/loss of material/M29.

See comment #5 for related issue.

RESPONSE:

The NRC staff partially agreed with this comment. As modified by the GALL-SLR Report and SRP-SLR Supplemental Staff Guidance document, there are parallel AMR items for aluminum tanks similar to stainless steel tanks. The aluminum tank items are addressed in separate AMR items because they cite a different further evaluation section (e.g., 3.2.2.2.10 versus 3.2.2.2.2) than for the stainless-steel items.

<u>Comment: 018</u>

Location of Change

SRP Tables

3.2-1, 99
3.3-1, 67
3.3-1, 129
3.3-1, 222
3.3-1, 225
3.4-1, 29
3.4-1, 93

GALL AMR rows

V.E.E-442	VII.I.A-754	VIII.C.S-441	VIII.E.S-441
VII.H1.A-402	VIII.A.S-441	VIII.D1.S-441	VIII.F.S-441
VII.H1.A-95	VIII.B1.S-441	VIII.D2.S-441	VIII.G.S-31
VII.I.A-751	VIII.B2.S-441	VIII.E.S-31	VIII.G.S-441

Description of Change

Editorial: Most GALL/SRP rows that recommend the XI.M29, "Aboveground Metallic Tanks" program list program applicability in the Structure and/or Component column [i.e., Tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks")]. These rows do not specify program applicability to the tank components.

Consider adding program applicability to component column.

Justification For Change

Consistency with other GALL/SRP rows.

Additionally, tanks that are not within the scope of the M29 program should not be assigned to it for aging management.

Note that the converse is also applicable: numerous rows for which the component type is listed similar to 'Tanks (within the scope of AMP XI.M29, "Aboveground Metallic Tanks")' do not specify the M29 program for management. Instead, these rows specify a plant-specific program. Incorporation of comment #5 should address these items.

RESPONSE:

The NRC staff partially agreed with this comment. Changes were incorporated in order to meet the final configuration of the GALL-SLR AMR items.

The NRC staff reviewed all of the AMR items, which cite AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," in the AMP column. Revisions were incorporated such that only 22 AMR items do not cite "within the scope of AMP XI.M29" in component column. Twelve of these items are associated with insulated tanks. For these AMR items, AMP XI.M29 is one of multiple AMPs that can used to manage loss of material or cracking; AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," being one of the other AMPs. There are eight AMR items that cite raw water, waste water, air, or condensation, as the environment. Again, AMP XI.M29 is just one of the recommended AMPs. There are two AMR items that cite soil or concrete as the environment. If soil or concrete is an applicable environment, then in all likelihood, AMP XI.M29 is the appropriate AMP.

The staff reviewed all of the AMR items which cite AMP XI.M29 in the component column. In all cases, the cited AMP is AMP XI.M29, AMP XI.M32, "One-Time Inspection," or AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." AMP XI.M32 is appropriately cited for one-time inspections associated with stainless steel, nickel alloy, or aluminum components exposed to air or condensation. AMP XI.M42 is cited as an alternative AMP if the applicant elects to manage loss of coating integrity for externally coated tanks in lieu of managing aging effects of the stainless steel, nickel alloy, or aluminum tank.

Comment: 019

Location of Change

SRP Table

3.3-1, 39

GALL AMR rows

IV.C1.RP-230
IV.C2.RP-235
GALL XI
XI.M35

Description of Change

Editorial: SRP and GALL AMR rows refer to the XI.M35 program as "One-Time Inspection of ASME Code Class 1 Small-bore Piping," while the program title/description in GALL XI is "ASME Code Class 1 Small-Bore Piping."

Consider making SRP and AMR line titles match the Chapter XI program title.

Justification For Change

Titles don't match. Program now includes an ongoing portion based on plant OE, so it is not always a One-Time program.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made.

Changes were made to: (i) SRP-SLR Table 3.1-1 (page 3.1-36), 2nd entry ID39; (ii) GALL-SRP Volume 1, Chapter IV, Table IV C1 (page IV C1-2) 2nd entry; and (iii) GALL-SRP Volume 1, Chapter IV, Table IV C2 (page IV C2-2), 2nd entry. The wording “One-Time Inspection of” was removed from those pages. Changes were made to ensure the title is consistent throughout the guidance documents.

Comment: 020

Location of Change

New SRP row

New GALL rows

Description of Change

Consider addition of new GALL rows for the following titanium MEAs:

HX tubes/Titanium/Treated water/Reduction of heat transfer/XI.M2 & XI.M32

Piping components, HX components other than tubes/Titanium (ASTM Grades 1, 2, 7, 11, or 12)/Treated water/None/None

HX tubes/Titanium/Closed cycle cooling water/Reduction of heat transfer/XI.M2 & XI.M32

Piping components, HX components other than tubes/Titanium (ASTM Grades 1, 2, 7, 11, or 12)/Closed cycle cooling water/None/None

Justification For Change

SLR GALL addresses titanium in some environments, but does not include some other environments in which titanium is used.

Reduction of heat transfer due to fouling for titanium tubes is identified as a potential aging effect in EPRI 1010639 (Mechanical Tools) appendix H for titanium tubes in treated water. The Mechanical Tools does not identify reduction of heat transfer for titanium tubes in Closed-cycle cooling water, but assumes that corrosion inhibitors and biocides are employed in CCCW to preclude fouling. The GALL Closed-cycle cooling water environment definition does not assume these additives, so it was compared to the Mechanical Tools’ Treated water environment for this evaluation.

Absence of aging effects for other piping and HX components in these environments is identified in EPRI 1010639 (Mechanical Tools) appendix A. Loss of material due to crevice corrosion is not expected at temperatures below 160°F (and requires the presence of oxygen and other contaminants above 160°F), which is not present in the Treated water (as opposed to Treated water >140°F) environment, or in the Closed cycle cooling water environment. Cracking is not expected in ASTM grades 1, 2, 7, 11, or 12 Titanium (and requires the presence of chlorides and other alloying constituents in other alloys). No other potential aging effects are identified in Treated water environments in the Mechanical Tools.

RESPONSE:

The NRC staff partially agreed with this comment and changes were incorporated as described below. The NRC staff responds to each of the suggested new AMR items as follows:

(a) Titanium heat exchanger tubes exposed to treated water for which reduction of heat transfer is managed by AMP XI.M2, "Water Chemistry" and AMP XI.M32, "One-Time Inspection." The industry's proposed use of AMP XI.M2 and AMP XI.M32 for this material, environment, and aging effect combination is consistent with other GALL-SLR Report items constructed of similar materials. Examples include: (a) nickel alloy, R-407; (b) stainless steel, E-20 and EP-74; and (c) copper alloy, SP-100. As is the case with all AMR items that cite titanium without specifying a specific grade of material, cracking due to SCC is cited as an applicable aging effect requiring management (AERM). Grades 3, 4, and 5 are susceptible to cracking while Grades 1, 2, 7, 9, 11, or 12 are not. For further details see the basis for associated AMR items.

(b) Titanium (ASTM Grades 1, 2, 7, 11, or 12) piping, piping components, and heat exchanger components other than tubes exposed to treated water, cite no AERM and no recommended AMP. This is consistent with GALL-SLR Report items AP-152 and AP-161 for the same material exposed to raw water. The treated water environment would be less aggressive. In addition, Uhlig's Corrosion Handbook, 3rd Edition, page 866 states "Excellent resistance of titanium to general corrosion in seawater is obtained to temperatures well in excess of 250 degrees C. This includes brackish, polluted, stagnant, aerated, or deaerated water containing contaminants such as metal ions, sulfides, sulfates, and carbonates."

(c) Titanium heat exchanger tubes exposed to closed-cycle cooling water for which reduction of heat transfer is managed by AMP XI.M2 and AMP XI.M32. The staff has concluded that it is appropriate to include this material, environment, and aging effect combination in the AMR items. However, managing reduction of heat transfer with AMP XI.M2 and AMP XI.M32 is not consistent with other AMR items. For example, reduction of heat transfer for stainless steel components exposed to closed-cycle cooling water is managed by AMP XI.M21A, "Closed Treated Water Systems," reference EP-96. AMP XI.M21A is also cited for copper alloy, reference EP-100. As a result, the staff cited AMP XI.M21A to manage reduction of heat transfer due to fouling for these components. As is the case with all AMR items that cite titanium without specifying a specific grade of material, cracking due to SCC is cited as an applicable AERM. Grades 3, 4, and 5, are susceptible to cracking while Grades 1, 2, 7, 9, 11, or 12, are not. For further details see the basis for associated AMR items.

(d) Titanium (ASTM Grades 1, 2, 7, 11, or 12) piping, piping components, and heat exchanger components other than tubes exposed to closed-cycled cooling water, citing no AERM and no recommended AMP. This is consistent with GALL-SLR Report items AP-152 and AP-161 for the same material exposed to raw water. The closed-cycle cooling water environment would be less aggressive. In addition, Uhlig's Corrosion Handbook, 3rd Edition, page 866 states "Excellent resistance of titanium to general corrosion in seawater is obtained to temperatures well in excess of 250 degrees C. This includes brackish, polluted, stagnant, aerated, or deaerated water containing contaminants such as metal ions, sulfides, sulfates, and carbonates."

<u>Comment</u>: <u>021</u>

Location of Change

SRP sections

1.1.5, 2.1.5, 2.2.5, 2.3.5, 2.4.5, 2.5.5, 3.1.5, 3.2.5, 3.3.5, 3.4.5, 3.5.5, 3.6.5, 4.1.5, 4.2.5, 4.3.5, 4.4.5, 4.5.5, 4.6.5, 4.7.5

Description of Change

SRP text allows for the proposal of acceptable alternative methods to those described in the GALL/SRP, but no guidance is provided for the determination of acceptability. Consider adding the following statement to the "Implementation" sections identified:

"Alternatives should be considered acceptable if:

- They provide reasonable assurance that component intended functions will be maintained, or

- If consistency with GALL/SRP recommendations would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety."

Justification For Change

The first criterion (reasonable assurance that component intended functions will be maintained) is consistent with the discussion of aging management reviews in SRP Appendix A, Section A1.1: "The subsequent license renewal (SLR) process is not intended to demonstrate absolute assurance that 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 CLB during the subsequent period of extended operation."

The second criterion is similar to that provided in 10 CFR 50.55a(z)(2) for acceptable alternatives to code requirements.

RESPONSE:

The staff did not agree with this comment. As a result, the staff did not make any changes to the contents of the referenced SRP-SLR sections.

Specifically, the commenter recommended that these sections should be amended to allow for the use of proposed alternatives if the alternatives would: (a) provide reasonable assurance that component intended functions will be maintained, or (b) if consistency with GALL-SRP Report recommendations would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety." The commenter's basis for allowing such alternatives are analogous to the criteria for submitting alternatives in ASME Code relief requests under the requirements of 10 CFR 50.55a(z). The staff determined that these types of alternative basis criteria are only relevant and appropriate for relief request submittals that are submitted in accordance with the 10 CFR 50.55a(z) requirements. Therefore, the staff did not make any changes based on this comment.

Source 015

Comment: 022

Location of Change

SRP FE 3.1.2.2.12

Description of Change

Section 3.1.2.2.12 (Cracking Due to Irradiation-Assisted Stress Corrosion Cracking) of the draft SRP-SLR includes

- IASCC of BWR Internals

  Although not described in Section XI.M9, this SRP-SLR section contains a "further evaluation" item associated with IASCC of BWR reactor internals. The concern expressed is that "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".

  However, this further evaluation discussion appears to be applied to many BWR internals, a significant number of which are exposed to fluences well below accepted thresholds for onset of irradiation effects in austenitic materials.

  The discussion also indicates that supplemental inspections may be needed. However, technical bases for recommending supplemental inspections are not included and there are no criteria that can be used by an applicant to ensure that the intent of this review item is satisfied. Recommend deletion of this FE topic, or identification of specific guidance.

  SRP-SLR Section 3.1.2.2.12 (2)–IASCC of BWR Access Hole Covers (AHCs)

  Similar to the discussion in Section 3.1.2.2.12 (1), this SRP section describes the need for further evaluation to address IASCC of BWR AHCs. IASCC of AHCs should be eliminated.

Justification For Change

- In the case of internals components subject to substantial neutron fluence, there is a robust existing database that can be used to characterize irradiated material performance. BWRVIP guidance for reactor internals subject to significant fluence include NRC-accepted evaluation standards that can be used to manage BWR reactor internals through the end of an SLR period.

  For example, BWRVIP-76 Rev. 1-A, BWRVIP-99-A, and BWRVIP-100-A include guidance for management of core shroud welds for EOL fluences as high as 1E22 n/cm^2, E ≥ 1.0 MeV. This fluence value bounds U.S. designed BWR through an 80-year service life.

- The fluence at the AHC is insignificant, at least an order of magnitude below the threshold for onset of irradiation effects in austenitic materials.

RESPONSE:

The staff did not agree with this comment. This comment established the opinion that further evaluation of the irradiation-assisted stress corrosion cracking (IASCC) mechanism in BWR RVI components is unnecessary because the BWRVIP reports assess the components for a bounding fluence of 1×10^{22} n/cm^2 (E > 1.0 MeV). The staff did not make any changes to the GALL-SLR Report or SRP-SLR reports based on receipt of this comment.

The updated GALL-SLR Report AMR items for BWR RVI components that are subject to the further evaluation guidelines found in SRP-SLR Sections 3.1.2.2.12 and 3.1.3.2.12 are as follows:

- item IV.B1.R-100 for managing cracking in BWR jet pump assembly components,
- item IV.B1.R-92 for managing cracking in BWR core shrouds that are made from stainless steel,
- item IV.B1.R-93 for managing cracking in BWR core plates and core plates bolts that are made from stainless steel (applies to early BWR model designs only),
- item IV.B1.R-94 for managing cracking in BWR core plate access hole covers (welded designs),
- item IV.B1.R-95 for managing cracking in BWR core plate access hole covers (mechanical designs),
- item IV.B1.R-96 for managing cracking in BWR core shroud support structures (including shroud support cylinders, plates, and legs) that are made from nickel alloy materials,
- item IV.B1.R-97 for managing cracking in BWR lower pressure coolant injection (LPCI) couplings,
- item IV.B1.R-98 for managing cracking in BWR top guide assembly components,
- item IV.B1.R-99 for managing cracking in BWR internal core spray lines and headers, spray rings, spray nozzles, and thermal sleeves,
- item IV.B1.R-105 for managing cracking in BWR Intermediate range monitor (IRM) dry tubes, source range monitor (SRM) dry tubes, and incore neutron flux monitor guide tubes, and
- new item IV.B1.R-422 for managing cracking due to IASCC in miscellaneous BWR reactor internal components not specifically mentioned in the listed items (a) – (j) above.

SRP-SLR AMR item 3.1-1, 103 references these GALL-SLR AMR items.

The staff did not agree with this comment because, for BWR applicants proposing subsequent life extension of their facilities, there is no guarantee that the neutron fluences for BWR RVI components through an 80-year life would still be bounded by those assumed and used to develop the applicable BWRVIP reports for the components. The staff's perspective continues to be that it is important for the applicant to verify that those assumed and used to develop the relevant BWRVIP inspection and evaluation report criteria for the components will still bound the

80-year projected fluences for the BWR reactor vessel internal components. Therefore, the further evaluation acceptance criteria guidelines in SRP-SLR Section 3.1.2.2.12 and the corresponding review procedures in SRP-SLR Section 3.1.3.2.12 will remain applicable to the basis for managing cracking due to SCC, IGSCC, or IASCC for BWR RVI components associated with AMR items listed in the previous paragraph.

Based on the evaluation of the comment, AMP XI.M9, "BWR Vessel Internals," and AMP XI.M2, "Water Chemistry," may continue to be used as an acceptable basis for managing cracking due to SCC, IGSCC, or IASCC in these components, but as subject to the new further evaluation acceptance criteria guidelines found in SRP-SLR Sections 3.1.2.2.12 and 3.1.3.2.12.

Comment: 023

Location of Change

SRP FE 3.1.2.2.14

Description of Change

Core Plate Holddown Bolts

SPR-SLR Section 3.1.2.2.14 addresses loss of preload in core plate holddown bolts due to stress relaxation:

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).

Comment:

This discussion implies that, regardless of analytical results, enhanced inspections of core plate holddown bolts are required for SLR. The content should be clarified to indicate that inspections are only required if there is not an adequate technical basis to justify continuation of the inspection exemption.

Justification For Change

This discussion implies that, regardless of analytical results, enhanced inspections of core plate holddown bolts are required for SLR. The content should be clarified to indicate that inspections are only required if there is not an adequate technical basis to justify continuation of the inspection exemption.

RESPONSE:

The staff did not agree with this comment, but did agree that some additional clarifications were appropriate for the contents of SRP-SLR Sections 3.1.2.2.14 and 3.1.3.2.14.

Specifically, the industry cited the guidelines in EPRI BWRVIP TR No. BWRVIP-25, Revision 1, as the basis for providing its opinion that further evaluation of core plate rim hold-down bolts is only necessary if the referenced TR could not demonstrate an adequate basis for eliminating the BWRVIP's existing augmented inspection criteria for the components. The flaw evaluation methodology that is specified in BWRVIP-25, Revision 1, for eliminating the augmented inspection basis for bolts is currently undergoing a review by the staff and has yet to be endorsed by the staff.

The staff did not agree with the comment because the inspection exemption basis referred in the comment is the subject of an updated EPRI BWRVIP report methodology that is still in review pending staff approval.

The staff did agree to incorporate some additional clarifications into the existing further evaluation sections in SRP-SLR Sections 3.1.2.2.14 and 3.1.3.2.14. Specifically, SRP-SLR Sections 3.1.2.2.14 and 3.1.3.2.14 have been updated to clarify that management of loss of preload in BWR core plate rim-hold-down bolts may be managed using either AMP condition monitoring or inspection bases or through performance of a TLAA (or both). If GALL-SLR Report AMP XI.M9, "BWR Vessel Internals," is used for aging management, the applicable BWRVIP inspection bases (e.g., BWRVIP-25) should be verified for acceptability. If a TLAA is used, the analysis methodology, results, and basis for accepting under 10 CFR 54.21(i), (ii), or (iii) should be discussed and justified in the SLRA.

Comment: 024

Location of Change

SRP FE 3.1.2.2.17

Description of Change

Section 3.1.2.2.17 of the draft SRP-SLR includes discussion related to further evaluation of management of IGSCC by XI.M7, BWR SCC, in the case of stagnant piping sections:

"…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 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."

Comment:

On the basis that the NRC review of BWRVIP-62 Revision 1 did not identify concerns with this guidance for dead legs, the BWRVIP maintains that the further evaluation recommendation in Section 3.1.2.2.17 of the SRP-SLR is not needed.

Justification For Change

It is true that hydrogen water chemistry technologies are not effective for some stagnant locations. However, BWRVIP-75-A includes the following language that was added to the applicable sections of BWRVIP-75-A as agreed by the BWRVIP and NRC and documented in the NRC SE for BWRVIP-75:

“In addition, locations having attributes that would promote IGSCC should have higher priority for inspection. The attributes that may be considered include: high carbon or low ferrite content, crevice or stagnant flow condition, evidence of weld repair, surface cold work, and high fit-up, residual and operating stresses.”

Additionally, Section 4.5 of BWRVIP-62 Revision 1 provides specific guidance for demonstrating mitigation in dead legs. BWRVIP-62 Revision 1 has been reviewed by NRC. None of the RAIs relate to the BWRVIP treatment of mitigation effectiveness demonstration for dead legs. Thus, existing guidance is available for use in determining the mitigation status for welds located in dead leg locations.

RESPONSE:

The staff agreed with this comment. The further evaluation section was deleted in conjunction with incorporating the changes to AMP XI.M7, “BWR Stress Corrosion Cracking,” described below.

The draft SRP-SLR cited a further evaluation for this item in order to recommend that the applicant provide an evaluation of the potential for dead legs and other piping locations with stagnant flow, which exacerbate SCC and IGSCC. BWRVIP-75-A (cited as a reference in AMP XI.M7), “BWR Vessel and Internals Project Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules,” Table 3-1, “Summary of Changes,” footnote 3b states that stagnant flow conditions should result in a higher priority for inspections. The staff revised the Detection of Aging Effects program element of AMP XI.M7 to incorporate the consideration of stagnant flow locations for selecting inspection locations. In addition, AMP XI.M7 was revised to recommend that the applicant identify these locations in the program.

Comment: 025

Location of Change

SRP-SLR, Administrative Information, Page 1.1-1, Lines 23 and 24

Description of Change

Starting on line 23 of the referenced section, there is a statement, “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.”

Include clarification that staff approval is indicated by publication of the SER (if that is the intent of the text).

Justification For Change

Clarify how staff approval is to be determined by the applicant, when SLRA has not been approved.

RESPONSE:

The NRC staff agreed with this comment and associated changes to the GALL-SLR Report have been made. The sentence will be deleted from the SRP-SLR for clarity purposes. The staff also added information from Inspector Manual Chapter 2516 “Policy and Guidance for the License Renewal Inspection Program” related to inspections at plants with a timely renewal application.

Comment: **026**

Location of Change

SRP-SLR, Administrative Information, sub-section 1.1.2.2, Page 1.1-2, Lines 8-10

Description of Change

Recommend deleting the last eight words from the sentence as follows:

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.*~~

Justification For Change

Determination of timeliness is separate from determination of sufficiency, as defined in 10 CFR 2.109(b).

RESPONSE:

The NRC staff disagreed with this comment. The GALL-SLR Report has not been changed.

In accordance with 10 CFR 2.109(b), if a licensee of a nuclear power plant licensed under 10 CFR 50.21(b) files a sufficient application for renewal at least 5 years before the expiration of the current existing license, the existing license will not be deemed to have expired until the application has been finally determined. The staff reworded the sentence for consistency with the regulations in 10 CFR Part 2.

Comment: **027**

Location of Change

SRP-SLR, Administrative Information, Table 1.1-1, Section I.2.B.b Page 1.1-5

Description of Change

Recommend eliminating the need to provide 13 copies of application.

Justification For Change

10 CFR 50.4 doesn’t currently require 13 copies of application. Many CD copies are provided to the Project Manager for the staff’s use.

Source 015

RESPONSE:

The NRC staff agreed with this comment and associated changes to the GALL-SLR Report have been made. Revised Table 1.1-1, Section I.2.B.b, Page 1.1-5 b. A signed original application and hard copies are provided to the Document Control Desk. One copy is provided to the appropriate Regional Office and one copy to the Regional Inspectors in accordance with the NRC docketing requirement in 10 CFR 50.4. The regulations in 10 CFR Part 54 do not require 13 copies of the license renewal application.

<u>Comment: 028</u>

Location of Change

SRP Sub-Section A.1.2, page A.1- 7, lines 1-4

Description of Change

The sentence beginning on line 1, with "Corrective action is taken, such as piping replacement, …" does not make sense.

Suggested text is "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*~~ <u>its</u> CLB design loads."

Justification For Change

Editorial–sentence garbled.

RESPONSE:

The staff agreed with the comment that the referenced sentence requires editorial modification, and as a result, has been deleted.

<u>Comment: 029</u>

Location of Change

SRP-SLR Page xxxiii, Line 8

Description of Change

Change the first sentence on Line 8 as follows:

The ~~*appendices*~~ <u>Appendix A</u> to the SRP-SLR lists branch technical positions <u>and provides review guidance related to use of operating experience for aging management programs</u>.

Justification For Change

There is only one Appendix (Appendix A), and the guidance provided relative to Operating Experience for Aging Management Programs is not a branch technical position; rather, it is an insert from LR-ISG-2011-05.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made.

Comment: 030

Location of Change

GALL section XI, page XI-5

Description of Change

After the section

GUIDANCE ON USE OF LATER EDITIONS/REVISIONS OF VARIOUS INDUSTRY DOCUMENTS, add:

GUIDANCE ON THE USE OF PAST PRECEDENCE TO EVALUATE EXCEPTIONS TO AGING MANAGEMENT PROGRAMS

To aid applicants in the evaluation of aging management program exceptions, an applicant may justify the exception by identifying that the exception was previously approved for the plant under review. To take this approach, the applicant is to confirm that the exception was previously approved and the applicant's exception and associated justification is consistent with the review in the applicant's initial License Renewal Safety Evaluation. An applicant may also use past precedence from another plant to justify the exception. To take this approach, the applicant is to confirm that the exception was previously approved and the applicant's exception and associated justification is consistent with the review in the reference plant's License Renewal Safety Evaluation.

Justification For Change

Provide guidance to aid in acceptance review of previously approved exceptions.

RESPONSE:

The staff partially agreed with this comment. The staff reviewed five recent applications for first license renewal to look for instances in which the staff in their review of the application had approved exceptions for what might be considered a generic condition at more than one utility. The staff reviewed the justification for the exceptions, and if appropriate for subsequent license renewal, added a new item.

However, it should be noted that the requirements for subsequent license renewal are not the same as for first license renewal. Thus, if an exception has been approved for first license renewal, it is not automatically approved for subsequent license renewal

Comment: 031

Location of Change

SRP section 3.0.1, page 3.0-4, lines 25-28

Source 015

Description of Change

Lines 25-28 should be revised as follows:

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. Exceptions are portions of the GALL-SLR Report AMP that the applicant does not intend to implement. ~~*However, any*~~ Any deviation or exception to the GALL-SLR Report AMP should be described and justified. The applicant may identify that the exception was previously approved for the plant under review. In this instance the reviewer is to confirm that the exception was previously approved and the applicant's exception and associated justification is consistent with the review in the applicant's initial License Renewal Safety Evaluation. The applicant may also use past precedence from another plant to justify their exception. In this instance, the reviewer is to confirm that the exception was previously approved and the applicant's exception and associated justification is consistent with the review in the reference plant's License Renewal Safety Evaluation.

Justification For Change

Provide guidance to aid in acceptance review of previously approved exceptions.

RESPONSE:

The staff did not agree with this comment and did not incorporate the changes to the referenced SRP-SLR section proposed in the comment.

The fact that an exception previously approved in the past LRA may be included as an exception in a SLRA does not necessarily correlate to a conclusion that the same exception would continue to be approved by the staff for the SLRA. Changes to NRC requirements, industry or NRC recommended positions; industry operating experience all could be valid reasons why past-approved exceptions would not be acceptable for the SLRA of a given plant. Therefore, as was done for LRAs processed in accordance with GALL, Revisions 0, 1, or 2, exceptions taken to criteria in GALL-SLR will need to be reviewed by the staff on a case-by-case basis.

Comment: 032

Location of Change

GALL VII.A2, page VII.A2-1

Description of Change

Change first sentence to read: "This section discusses those structures and components (SCs) used for spent fuel storage and includes ~~*stainless steel (SS)*~~ spent fuel storage racks (typically made of stainless steel) and neutron-absorbing materials (e.g., Boraflex, Boral®, or boron-steel sheets, if used) submerged in chemically treated oxygenated boiling water reactor (BWR) or borated pressurized water reactor (PWR) water."

Justification For Change

Some racks utilize varying types of aluminum as the structural materials instead of stainless steel. Stainless steel is typical, but is not used exclusively.

RESPONSE:

The staff agreed with this comment. The change was partially incorporated as requested; however, the term "stainless steel" was inadvertently not deleted from in front of "spent fuel storage racks." The change as proposed makes the statement inclusive of alternative spent fuel rack materials of construction.

Comment: 033

Location of Change

GALL VII.A2
Page VII.A2-1, line 7

Description of Change

Revise second sentence to read: "~~*Boraflex*~~ Neutron absorber sheets fastened to the storage cells provide for neutron absorption and help maintain subcriticality of spent fuel assemblies in the spent fuel pool (SFP).

Justification For Change

Sentence should apply to all types of neutron absorbers.

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested. The change makes the statement inclusive of alternative neutron absorber materials of construction.

Comment: 034

Location of Change

GALL VII.A2
Page VII.A2-1, line 12, 13

Description of Change

Revise sentence to read: "In some plants, the Boraflex has been replaced by ~~*Boral® or boron steel*~~ metallic based absorber materials.

Justification For Change

The majority of modern Boraflex replacements have been made by using Boralcan or Metamic. The reference to BORAL and boron steel (1 plant) may not represent the typical configuration.

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested. The change makes the statement inclusive of alternative neutron absorber materials of construction.

Source 015

<u>Comment: 035</u>

Location of Change

SRP-SLR section 3.1.3.2.3, page 3.1-16, lines 41-42

Description of Change

Why is the safety evaluation for MRP-227, Revision 0 (i.e., no SLR) being referenced herein? Recommend deleting the MRP-227 Revision 0 reference.

Furthermore, the Applicant/Licensee Action Item (A/LAI) being referenced in this sentence appears to be A/LAI 8, parts 3, 4, and 5.

Justification For Change

These A/LAI parts are only required for applicants who submit applications for (first) license renewal after the issuance of the MRP-227 Rev 0, safety evaluation. There is no allowance in A/LAI 8 for second license renewal (SLR) in relation to the aforementioned safety evaluation.

RESPONSE:

The staff partially agreed with this comment and the appropriate changes to SRP-SLR Section 3.1.3.2.3 have been made.

The staff agreed that the referenced sentence made an improper reference to ERPI Report No. MRP-227, Revision 0, and that the sentence should have properly referred to the B&W vendor report that included the applicable reduction in ductility analysis for reactor internals in B&W-designed PWRs. However, the need for performing a reduction of ductility analysis for B&W-designed reactor internals was established in an action item that was issued in the staff's safety evaluation of AREVA's BAW-2248A topical report. The report was submitted by the B&W Owners Group on behalf of its industry members. Thus, the referenced sentence in SRP-SLR Section 3.1.3.2.3 has been appropriately corrected and amended to state:

"*The NRC staff reviews the evaluation of this TLAA following the guidance in Section 4.7 of this SRP-SLR consistent with the action item documented in the NRC staff's safety evaluation for B&W Owners Group report number BAW-2248, which is included in BAW-2248A, March 2000.*"

<u>Comment: 036</u>

Location of Change

SRP-SLR section 4.2.3.1.3.2, page 4.2-9, lines 21, 24

Description of Change

The temperature difference (standard deviation) Fahrenheit to Celsius conversion is performed incorrectly.

Justification For Change

Δ°F = 1.8*Δ°C. That is, the deviations should be 15.6 °C and 7.8 °C rather than -2.2 °C and -10 °C.

RESPONSE:

The staff agreed with this comment and appropriate corrections to SRP-SLR Section 4.2.3.1.3.2 have been made.

The staff agreed to correct the Celsius degree (˚C) references on lines 21 and 24 of SRP-SLR Page 4.2-9 to 15.6 degrees C and 7.8 degrees C and make the appropriate administrative changes of the paragraph. The staff determined that the previous degrees C temperature values listed in SRP-LR Revision 2, version of the paragraph should not have been amended to absolute degrees C values and that the relative, delta degrees C values from SRP-LR, Revision 2, should have been retained. Other administrative edits were incorporated into sentences in lines 16-24 of SRP-SLR page 4.2-9. Thus, the section containing the referenced sentence has been amended to read:

> *"For the surveillance data to be defined as credible, the difference in the predicted values and the measured values for delta RT_{NDT} (ΔRT_{NDT}) must be less than 15.6 °C [28 degrees F] for weld metal components or less than 9.4 degrees C [17 degrees F] for base metal components. 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. The standard deviation for the ΔRT_{NDT} used in the margin term assessment (e.g., σ_{Δ}) of the RT_{PTS} calculations may be reduced from 15.6 degrees C [28 degrees F] to 7.8 degrees C [14 degrees F] for welds or from 9.4 degrees C [17 degrees F] to 4.7 degrees C [8.5 degrees F] for base metal materials. However, σ_{Δ} need not exceed one-half of the RT_{NDT} value used in the RT_{PTS} calculations."*

Comment: 037

Location of Change

GALL Table IX.D, page IX D-2

Description of Change

(Environment) Air with metal temperature up to 288 °C [550 °F]–delete and replace with air-indoor uncontrolled

Justification For Change

This environment applies to GALL AMR line IV.C2-R-19 for cracking and cyclic loading of pressurizer integral supports that is managed by XI.M1 ASME Section XI Inservice Inspections Subsection IWB, IWC, and IWD. Due to the unique component, a high temperature environment during normal plant operations would be assumed for this component. Specifying a 288°C environment is not necessary.

Source 015

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The only affected GALL-SLR item is IV.C2.R-19. This item addresses cracking due to cyclic loading of steel or stainless-steel pressurizer integral supports. The air with metal temperature up to 288 °C (550 °F) environment was changed to any environment (in lieu of air-indoor uncontrolled proposed by the industry) because cracking due to cyclic loading is not dependent on a specific air environment. Cracking due to cyclic loading can occur in any environment.

Comment: 038

Location of Change

GALL Table IX.D,
page IX D-2

Description of Change

(Environment) Air with steam or water leakage–delete and replace with air-indoor uncontrolled

Justification For Change

This environment applies to a series of GALL lines for cracking and loss of material of closure bolting that is managed by XI.M18, Closure Bolting Program. AMR lines that apply to closure bolting cracking identify high strength steel bolts as the applicable component. In addition, AMP XI.M18 manages the closure bolting environments to periodically inspect for system leakage and correct its cause.

RESPONSE:

The staff partially agreed with the comment. The term "air with steam or water leakage" was deleted as requested; however, in some instances, as described below, a term other than "air-indoor uncontrolled" was used.

The responses to Comments 015-039 through 015-040 are combined in this one response because the environment "air with reactor coolant leakage" was similarly deleted. The bases for all of the GALL-SLR Report AMR item changes are as follows:

- A-03, E-02, and S-02: These items cited loss of material due to general (steel only), pitting, and crevice corrosion for steel, stainless steel, and nickel alloy closure bolting. These items cited an environment of air with steam or water leakage. In the process of determining whether the air with steam or water leakage environment could be deleted from these AMR items, the staff determined that the appropriate environments for all of these items are air-indoor uncontrolled, air–outdoor, and condensation. The three cited environments represent those air-related environments to which it is expected that closure bolting could be exposed and aging effects would occur. The air-indoor controlled was considered; however, consistent with other GALL-SLR items (e.g., EP-4), loss of material sufficient to result in a loss of intended function for closure bolting is not anticipated for this environment. In addition, visual inspections for leaking bolted connections on refueling outage intervals are recommended by AMP XI.M18, “Bolting Integrity.” These inspections can be capable of detecting closure bolting degradation prior to a loss of intended function.

- A-04, E-03, and S-03: These items cited cracking due to cyclic loading and cracking due to SCC for steel high-strength closure bolting. These items cited an environment of air with steam or water leakage. In the process of determining whether the air with steam or water leakage environment could be deleted from these AMR items, the staff determined that the appropriate environments for all of these items are air, soil, and underground. The staff has concluded that moisture can be present in any of the indoor air environments including air-indoor controlled, air-indoor uncontrolled, air-outdoor, and condensation. Sometimes this moisture is present in the air itself and can result in condensation on the surfaces of the closure bolting. Moisture can also be present due to leakage from nearby components or the component itself (e.g., leakage from flanged connections or valve packing). The staff accepts that pressure boundary leakage would be considered as event driven and is not considered as a source of moisture that could cause aging effects. However, SRP-SLR Section A.1.2.1 states that, “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.” Aggressive environments that are known to result in cracking of steel high-strength closure bolting due to SCC are aqueous solutions containing halides (e.g., chloride). Insulation is a potential significant source of halides whether it is installed on the in-scope component or on components in the vicinity of the in-scope component. Sufficient halide concentrations to cause SCC could be present due to leakage from nearby components or the component itself (e.g., leakage from flanged connections or valve packing). The term “air” (with the inclusion of condensation) captures all the potential air environments where moisture could be present. Transportable halogens can also be present in the soil and underground environment due to the potential presence of groundwater. Cracking due to cyclic loading is not dependent on a specific air environment. Cracking due to cyclic loading can occur in any environment.

- A-704, E-422, R-450, and S-403: These items cited reduced thermal insulation resistance for non-metallic thermal insulation due to moisture intrusion exposed to a variety of environments depending on the specific GALL-SLR Report chapter. For example, R-450 cited an environment of air-indoor uncontrolled, air-outdoor environment, air with borated water leakage, air with reactor coolant leakage, and air with steam or water leakage. In the process of determining whether the air with reactor coolant leakage and air with steam or water leakage environments could be deleted from these AMR items, the staff determined that the appropriate environments for all of these items are air and condensation. The staff has concluded that, as stated above, the terms “air” and “condensation” capture all the potential air environments where moisture could be present.

- R-10, R-11, R-78, RP-42, RP-51, RP-52, RP-53, and RP-165: These items cited cracking due to SCC or IGSCC, or loss of material for steel and stainless-steel closure bolting, reactor vessel closure flange assembly components (e.g., flange, studs, nuts, and washers), and control rod drive head penetration flange bolting exposed to air with reactor coolant leakage. The air with reactor coolant leakage was changed to air-indoor uncontrolled because this is the normal environment in the vicinity of these components. The term “air-indoor uncontrolled” was revised in GALL-SLR Report Chapter IX to state that the potential for leakage from bolted connections (e.g., flanges, packing) exists when citing the air-indoor uncontrolled environment, for clarity.

- R-12 and R-80: These items cited loss of preload for steel and stainless-steel closure bolting or control rod drive head penetration flange bolting exposed to air with reactor coolant leakage. The air with reactor coolant leakage was changed to air-indoor uncontrolled because this is the normal environment in the vicinity of these components.

- RP-54 and RP-201: These items cited cumulative fatigue damage: cracking due to fatigue, cyclical loading for steel reactor vessel closure flange assembly components (i.e., closure flanges, studs) exposed to air with reactor coolant leakage. The air with reactor coolant leakage was changed to air-indoor uncontrolled because this is the normal environment in the vicinity of these components.

- R-61 and R-74: This item cited cracking due to SCC or IGSCC for stainless steel or nickel alloy top head enclosure: vessel flange leak detection line. These items cited an environment of air with reactor coolant leakage or reactor coolant. The air with reactor coolant leakage was changed to air-indoor uncontrolled. The term, “reactor coolant” was revised to “reactor coolant leakage.” These environments describe the normal state of the environment inside of the piping when it is not filled with fluid or subject to leakage.

- R-79: This item cited loss of material due to wear for stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage. The air with reactor coolant leakage was changed to air-indoor uncontrolled because this is the normal environment in the vicinity of these components.

Comment: 039

Location of Change

GALL Table IX.D, page IX D-2

Description of Change

(Environment) Air with reactor coolant leakage–delete and replace with air-indoor uncontrolled

Justification For Change

With exception of TLAA lines, this environment applies to a series of GALL lines for cracking and loss of material of closure bolting that are managed by XI.M18, Closure Bolting Program or XI.M3 Reactor Head Closure Stud Bolting. AMR lines that apply to closure bolting cracking identify high strength steel bolts as the applicable component. In addition, AMP XI.M18 manages the closure bolting environments to periodically inspect for system leakage and correct its cause. TLAA lines assume a high temperature environment to produce the thermal cycle or cyclic loading required for the TLAA.

RESPONSE:

The staff partially agreed with this comment. See the previous response to Comment 015-038.

<u>Comment</u>: <u>040</u>

Location of Change

GALL AMR rows IV.A2.R-74 and IV.A1.R-61, pages IV A2-2, IV A1-7

Description of Change

(Environment) Air with reactor coolant leakage (internal)-for this and the reactor coolant environments in AMR lines, replace both with air-indoor uncontrolled

Justification For Change

AMR lines associated with this environment also identify reactor coolant as an environment. Both environments should be deleted and replaced with the air-indoor uncontrolled environment. The two plant-specific AMR lines associated with this environment manage cracking of the top hat/vessel flange leak detection lines. Recommend that the further evaluation describe the potential for reactor coolant leakage environment in these top hat/vessel flange leak detection lines.

RESPONSE:

The staff partially agreed with this comment. See the previous response to Comment 015-038.

<u>Comment</u>: <u>041</u>

Location of Change

GALL Table IX.D, page IXD-3

Description of Change

(Environment) Gas (internal)–revise environment description to clarify and show applicability regarding compressed air systems

Justification For Change

The gas (internal) environment for instrument and service air systems is recommended to apply to system components downstream of the system air dryers and would be evaluated as no aging effects and no aging management. In addition to maintaining internal air quality downstream of the compressed air system dryers; XI.M24, Compressed Air Monitoring, would perform ~~*a one-time*~~ an opportunistic inspection to confirm that unacceptable degradation is not occurring downstream of the dryers and ensure the intended functions of affected components are maintained during the period of extended operation. The dryers and upstream components would be evaluated in an air indoor uncontrolled or condensation environment with applicable aging effects managed by XI.M38, Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components. Use of XI.M24 does not change the docketed response to GL 88-14 for the rest of the plant operations.

RESPONSE:

The staff partially agreed with this comment. The change was incorporated as described below.

Source 015

The comment recommends that the dry air downstream of the compressed air system air dryers be incorporated into the term “gas” as used in GALL-SLR Report Chapter IX.D, “Use of Terms for Environments.” The staff concluded that incorporating the environment associated with the dry air downstream of the air dryers into the term “gas” could result in confusion in relation to backup accumulators that are filled with gas (e.g., nitrogen). The term “gas” was modified to delete the term dry air, and the term “air-dry” was revised to specifically cite the environment downstream of air dryers.

Source 016: NEI Attachment 3—Mechanical AMPs X.M1—XI.M22

Comment: 001

X.M1 Title - page X.M1-1

Revise program name from Cyclic Load Monitoring back to Fatigue Monitoring

Basis:

Leave program name the same for consistency with current license renewal program and affected utility program documents. This is not a new program and it is based upon the GALL Revision 2 program, so there is no justification for changing its name. The program scope description makes it clear that it addresses all types of cyclic load analyses. It also explains that it can monitor various input parameters, including cyclic loadings, or output parameters, including cumulative fatigue usage or crack growth, which are compared to applicable limits.

Markup

X.M1 ~~*Cyclic Load*~~ *FATIGUE* MONITORING

RESPONSE:

The staff agreed with this comment. Based on acceptance of the comment, the staff agreed to keep the title of the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report Aging Management Program (AMP) X.M1, “Fatigue Monitoring,” as specified in the version of this AMP in NUREG–1801, Revision 2.

Comment: 002

X.M1 Program Description Page X.M1-1, first paragraph

First paragraph “component locations in the reactor coolant pressure boundary….” It must be clearly stated here that only Class 1 components and piping are being addressed by this requirement.

Basis:

Note that NUREG–1800 Rev 2 states in Section 4.3.2.1.3 “Environmental Fatigue Calculations for Code Class 1 Components”, so X.M1 should only apply to Class 1 components. The program should state that reactor pressure vessel internals do not fall under this requirement.

Markup

…for ~~*specific*~~ *Class 1* mechanical or structural components; (b) fatigue analysis calculations for assessing…

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

Specifically, the commenter proposed changes to clause (a) in the referenced program description sentence. However, clause (a) in the referenced sentence applies to plant components that have been analyzed with an American Society of Mechanical Engineers (ASME) defined cumulative usage factor (CUF) analysis in the design basis or with a similar type of design basis analysis, such as an I_t analysis for ASME Code Class 1 large bore pumps and valves. However, the applicants for some past license renewal applications (LRAs) may have identified that some reactor internal components or some non-ASME Code Class 1 mechanical components have been analyzed with ASME design basis CUF analyses. Based on a plant's current licensing basis (CLB), the design basis CUF analyses for the CLB may not be limited only to those components that are part of the reactor coolant pressure boundary. Therefore, clause (a) in the sentence must remain as issued in the draft document to account for the fact that the CLB of a given plant may include CUF analyses for components that are not part of the reactor coolant pressure boundary.

It is clause (b) in the referenced sentence that pertains to plant components with environmentally-assisted fatigue analyses (CUF_{en} analyses), and the commenter did not propose any changes to clause (b) in the referenced sentence. Therefore, the staff considers the existing wording of the referenced sentence to be adequate without the need for any adjustments of the sentence.

Comment: 003

X.M1 Program Description Page X.M1-1, third paragraph

Clarify that the second aspect of the program described includes cycle-based fatigue monitoring (CBFM) which uses design transient occurrences, and stress-based fatigue monitoring (SBFM), in which actual plant operating conditions (fluid temperatures, pressures, and flow rates) are monitored. These values are periodically used to compute CUF values to-date, which are then compared to the design limit of 1.0. These methods provide a more accurate computation of the fatigue effects of each transient on the monitored components and have been accepted for use by the NRC staff in the past. These methodologies can also be used to confirm the CUF_{en} values to-date are less than the limit of 1.0 for components with environmental fatigue analyses. As noted in the Operating Experience section of this AMP, NRC Regulatory Issue Summary (RIS) 2008-30 must be considered when using the SBFM method.

Basis:

Cycle-based and stress-based fatigue monitoring methods are currently in use at many plants and their continued use should be explicitly permitted during the subsequent period of extended operation. The CBFM method periodically determines the cumulative fatigue to-date using the number of occurrences of design transients to-date as input to the fatigue table for the component being monitored. The SBFM method provides an even more accurate assessment of the actual condition of the component. Reducing this excess conservatism may be necessary in order to maintain the monitored fatigue usage below the limit of 1.0 through the subsequent period of extended operation and beyond.

Markup

For the latter, actual plant operating conditions monitored by this program can be used to inform updated evaluations of the fatigue analyses to ensure they continue to meet the design or analysis-specific limit. *This option may include stress-based fatigue monitoring, in which operating temperatures, pressures, and other parameters are monitored and used to determine the effects of actual operating transients on the cumulative CUF and CUFen for the analyzed* *components. This option periodically compares cumulative CUF and CUFen to the limit of 1.0.* Technical specification requirements may apply to these activities.

RESPONSE:

The staff partially agreed with this comment. The staff modified the third paragraph in the program description of GALL-SLR Report AMP X.M1, "Fatigue Monitoring," but in a manner that slightly differed from the change proposed in the comment.

For this comment and other comments related to use of stress-based monitoring methods, the staff agreed that the program description and program elements in AMP X.M1 should provide allowances for use of stress-based monitoring techniques. However, the staff did not incorporate the exact wording of the changes proposed by the commenter. Specifically, the staff did not include the commenter's proposed sentence that cites a limit of 1.0 on CUF and CUF_{en} values because some CUF analyses may set limits on CUF other than a value of 1.0. For example, CUF assessments associated with high-energy line break (HELB) assessments in the design basis may set limits on CUF values in the HELB analyses to values that are one-tenth of CUF limits used for ASME-defined design basis CUF calculations in the CLB (i.e., the HELB analyses set limits on CUF values to a value of 0.1).

Therefore, to address this comment, the staff amended the third paragraph of the program description for AMP X.M1 to include the following sentences:

> "For the latter, actual plant operating conditions monitored by this program can be used to inform updated evaluations of the fatigue analyses to ensure they continue to meet the design or analysis-specific limit. The program may include stress-based fatigue monitoring, in which operating temperatures, pressures, and other parameters are monitored and used to determine the effects of actual operating transients on the cumulative CUF and CUF_{en} for the analyzed components. Technical specification requirements may apply to these activities."

Comment: 004

X.M1 Program Description Page X.M1-1, fourth paragraph

Add the following statement as an alternative to cycle counting. "As an alternative to monitoring transient cycles, the AMP may also directly monitor the critical thermal and pressure transient parameters (temperature, pressure, and flow rate) to determine the actual severity of each event and to compute the resulting fatigue usage affecting specific component locations."

Basis:

This statement will make this paragraph consistent with the revised third paragraph amended as described above. The current GALL-SLR sentence above should be revised as proposed above to more closely align it with GALL Revision 2. Monitoring local conditions at critical locations to assess fatigue should be presented as a potential alternative to tracking local transients. This is clearly the intent of GALL, Revision 2. For example, many complex thermal stratification transients can occur in the surge line during heatups and cooldowns. Counting these transients manually would be cumbersome for utility engineers. In this case, monitoring fatigue locally at critical locations by explicitly considering the relevant plant operating parameters is a more efficient and accurate method of assessing the fatigue-effects of these transients, and therefore precludes the need to track the local thermal stratification transients explicitly.

Markup

CUF design limits, for example, values used for high energy line break considerations.) In order not to exceed the design limit on CUF, the AMP monitors and tracks the number of occurrences of each of the critical thermal and pressure transients for the selected components, and verifies that the severity of each of the monitored transients is bounded by the design transient definitions. *As an alternative to monitoring transient cycles, the AMP may also directly monitor the critical thermal and pressure transient parameters (temperature, pressure, and flow rate) to determine the actual severity of each event and to compute the resulting fatigue usage affecting specific component locations.*

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made.

For these comments and other comments related to use of stress-based monitoring methods, the staff agreed that the program description and program elements in GALL-SLR Report AMP X.M1, “Fatigue Monitoring,” should provide allowances for use of stress-based monitoring techniques. However, the staff did not agree with the exact wording of changes proposed by the commenter. Specifically, the staff did not use the exact wording of the commenter’s proposed sentence because stress-based CUF calculations may be based on a plant-specific methodology for performing the calculations and may involve the assessment of design parameters that do not strictly fall into the category of thermal or pressure transient parameters. Therefore, the staff amended the referenced paragraph by using wording more generic than that proposed by the commenter. To address this comment, the staff added the following sentence to the end of the fourth paragraph of the program description for AMP X.M1:

> “In order not to exceed the design limit on CUF, the AMP may be used to directly monitor the number of transient occurrences (i.e., transient cycles) or else to monitor applicable design transient parameters (e.g., temperatures, pressures, displacements, strains, flow rates, etc.) for components with stress-based fatigue calculations, such that the actual severity of each event is evaluated and used to compute the resulting fatigue usage factors for the impacted component locations.”

Comment: 005

X.M1 Program Description Page X.M1-1, fourth paragraph

Delete the note: “(Note that other values may be used as CUF design limits, for example, values used for high energy line break considerations).”

Basis:

EPRI Report 1022873, “Improved Basis and Requirement for Break Location Postulation,” dated October 2011, Section 7.0, “Conclusion,” states that “OE clearly indicates that the potential for high energy line failures is dominated by mechanisms other than thermal fatigue due to design plant transients.” It further states that the “consideration of fatigue usage by itself is not a reliable approach to predict crack initiation or leakage." As a result, the use of HELB values as a CUF design limit should not be considered and the statement should be deleted from the AMP.

Markup

…subjected to cyclic stresses. Crack initiation is assumed to begin in a mechanical or structural component when the CUF at a point on or in the component reaches the value of 1.0, which is the ASME Code Section III design limit on CUF values. (~~*Note that other values may be used as CUF design limits, for example, values used for high energy line break considerations.)*~~

RESPONSE:

The staff disagreed with this comment. The staff did not incorporate the change to the program description of GALL-SLR Report AMP X.M1, "Fatigue Monitoring," that was proposed in the comment.

Specifically, an applicant would establish specific design parameter limits in its plant-specific design basis for each type of analysis that is within the scope of this type of AMP. For example, HELB assessments are typically defined as a plant-specific chapter or section in the Final Safety Analysis Report (FSAR), Updated Safety Analysis Report (USAR), or Updated Final Safety Analysis Report (UFSAR). These HELB assessments typically establish a utility's basis for determining whether high-energy piping systems in the plant design need to be physically restrained and for selecting pipe whip restraint locations in the systems. The HELB design basis assessments for some systems may use alternative CUF acceptance criteria (e.g., 0.1) that are different from those that are used to accept design basis CUF calculations performed in accordance with ASME Section III rules, which apply a CUF acceptance criterion value of 1.0.

In addition, the Electric Power Research Institute (EPRI) report referenced in the comment may or may not be applicable to an applicant's CLB. Therefore, reference of the EPRI document does serve as an adequate basis for deleting the referenced parenthetical clause from paragraph 4 in the program description. The referenced parenthetical note will be retained in the program description of GALL-SLR Report Chapter X.M1; however, the inclusion of parenthetical note does not impose any additional criteria or requirements on an applicant applying for subsequent license renewal (SLR).

Comment: 006

X.M1 Program Description Page X.M1-1, fifth paragraph

Need to include a functional description of what can be done to identify the "plant-specific component location". See markup below for suggested wording.

Basis:

The paragraph below should be included in the document because it is not apparent to industry how one identifies the limiting location that satisfies the intent of X.M1. The markup below should be offered at least as an example of a functional (non-prescriptive) procedure that could be used to allow this identification.

Source 016

Markup

To identify the "plant-specific component location" an appropriate screening analysis can be performed. This screening analysis can consist of a grouping of Class 1 piping and components that have approximately the same structural properties and experience approximately the same thermal transients that can cause material fatigue. An appropriate fatigue analysis can be performed on the component or piping location representative of the group. The plant-specific component that is more limiting than the locations identified in NUREG/CR-6260 can be identified by reviewing the results of the fatigue analysis of the individual groups.

Structural Integrity Associates, Inc. (SIA) had one minor alteration to the commenter's proposed change to the fifth paragraph in AMP X.M1, as quoted above. SIA's correction proposed deletion of the words "six (6)" in the last sentence of the commenter's markup. SIA's reason for its correction of the proposed markup was that, in NUREG/CR-6260, the different NSSS designs and vintages have varying numbers of locations mentioned and were not always a value of six. Thus, SIA recommend that the specific number of locations not be mentioned in the referenced sentence because the point of the sentence is understable without inclusion of the words "six (6)".

RESPONSE:

The staff did not agree with this comment. The staff did not incorporate the proposed change to the program description of GALL-SLR Report AMP X.M1, "Fatigue Monitoring." However, the staff did amend Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Sections 4.3.2.1.2 and 4.3.3.1.2 in manner that addressed the perspective made in the comment.

In regard to managing the effects of aging due to environmentally-assisted fatigue, part of the purpose of AMP X.M1 is to monitor and track the number of occurrences and severity of each of the critical thermal and pressure transients assumed in the environmentally-assisted fatigue analyses [i.e., CUF_{en} time-limited aging analysis (TLAAs)]. The program in AMP X.M1 is not the place for the staff to provide a recommended methodology for the screening and selection of plant-specific component locations in the environmentally-assisted fatigue (i.e., CUF_{en}) calculations. Consistent with past LRAs, a SLR applicant should provide its basis for selecting the appropriate plant-specific component locations in the evaluation and for dispositioning of its environmentally-assisted fatigue analysis (i.e., CUF_{en} analysis) under 10 CFR 54.21(c)(1)(i), (ii), or (iii) using the guidelines given for these types of analyses in SRP-SLR Section 4.3.

However, SRP-SLR Table 4.1-2 identifies that environmentally-assisted fatigue analyses are generic TLAAs for subsequent license renewal applications (SLRAs). Therefore, based on this comment and other similar comments received from the Nuclear Energy Institute (NEI) in public meetings on SLR during May and June 2016, the staff agreed to modify SRP-SLR Sections 4.3.2.1.2 and 4.3.3.1.2 to better define the various types of regulatory bases that could be used to select specific reactor coolant pressure boundary locations for inclusion in environmentally-assisted fatigue calculations. The changes would allow more limiting locations in the reactor coolant pressure boundary to be used in the CUF_{en} calculations from those specified in NUREG/CR–6260 if that was previously approved for an applicant's CLB. Therefore, to address this comment, the staff amended the acceptance criteria guidance in SRP-SLR Section 4.3.2.1.2 and the review procedure guidance in SRP-SLR Section 4.3.3.1.2 to include the following additional sentences:

> "This sample set includes the locations identified in NUREG/CR–6260 (Ref. 11) and additional plant-specific component locations in the reactor coolant pressure boundary if they may be more limiting than those considered in NUREG/CR–6260. Plant-specific justification can be provided to demonstrate that calculations for the NUREG/CR–6260 locations do not need to be included."

Comment: 007

X.M1 Program Description - Page X.M1-2, first paragraph

Regulatory Guide (RG) 1.207, Revision 1, does not endorse the use of NUREG/CR–5704 for stainless steel components or NUREG/CR–6583 for carbon and low-alloy steel components, each of which was deemed acceptable in GALL, Revision 2. Add these NUREGs back into the list of acceptable methods for evaluating environmental fatigue, or provide the rationale for why the earlier NUREGS were not acceptable for SLR.

Basis:

For applicants that previously used these NUREGs, this would require the environmental fatigue analyses to be performed over again for subsequent license renewal, which should not be necessary unless the analyses indicate the CUFen values will exceed 1.0 through the subsequent period of extended operation. No justification has been provided that indicate these standards are unacceptable, so their continued use is acceptable. If using these NUREGs is still more conservative for a PWR and/or BWR or for a particular material type, there should be latitude to re-use these NUREGs.

Markup

NUREG/CR–6260, and thus should also be considered. Environmental effects on fatigue for these critical components may be evaluated using the guidance in Regulatory Guide (RG) 1.207, Revision 1 *or in NUREG/CR-6583 for carbon steel components or NUREG/CR-5704 for stainless steel components*. Similar to monitoring *against* CUF limits, the AMP monitors and tracks…

RESPONSE:

The staff partially agreed with this comment. The staff also partially accepted commenters' basis for making the changes to the fifth paragraph in the program description of GALL-SLR Report AMP X.M1, "Fatigue Monitoring," but opted to incorporate a modified version of the sentences proposed by the commenter.

Specifically, the staff agreed that, if previous environmentally-assisted fatigue calculations were approved by the staff in its safety evaluation report for the initial LRA using one or more of the earlier NUREG reports (i.e., either NUREG/CR–5704 for stainless steel components or NUREG/CR–6583 for alloy steel or carbon steel components), continued use of the reports could be justified for the assessment of these types of TLAAs during a proposed subsequent period of extended operation, but only for the case where the applicant would be dispositioning the relevant environmentally-assisted fatigue analysis in accordance with the criterion in 10 CFR 54.21(c)(1)(i) and demonstrating that the previous TLAA will be valid during the subsequent period of extended operation. This type of basis was provided in the staff's adjustments of the updated acceptance criteria in SRP-SLR Section 4.3.2.1.2.1 and review procedures in SRP-SLR Section 4.3.3.1.2.1.

However, the staff’s perspective was that, if a subsequent license renewal applicant would be updating its environmentally-assisted fatigue TLAA in the SLRA under 10 CFR 54.21(c)(1)(ii) or as part of the basis for using the Fatigue Monitoring program to accept the TLAA in accordance under 10 CFR 54.21(c)(1)(iii), any updates of the TLAA should be done using the most recent technology for performing environmentally-assisted fatigue calculations. As a result of this review, the staff agreed to incorporate an additional clarification in the fifth paragraph of the AMP program description but in a modified version of the sentence proposed by the commenter. Therefore, the staff amended the fifth paragraph in the program description of the GALL-SLR Report AMP X.M1 to include the following statement:

> Environmental effects on fatigue for these critical components may be evaluated using the guidance in Regulatory Guide (RG) 1.207, Revision 1; alternatively, the bases in NUREG/CR–6909, Revision 0 (with “average temperature” used consistent with the clarification that was added to NUREG/CR–6909, Revision 1); or other subsequent U.S. Nuclear Regulatory Commission (NRC)-endorsed alternatives.

Comment: 008

X.M1 Program Description—Page X.M1-2, third and fourth paragraph

Add wording “analysis assumptions controlling” as indicated in markup.

Basis:

Note that on page X.M1-2, the statements describing monitoring of (Appendix-L) Flaw Tolerance and (Appendices A/C) fracture mechanics analyses are very specific and do not account for situations where monitoring between inspections is simply time-based, and not directly based on monitoring of transient cycles at the affected component.

Markup

… parameter that is used to determine the appropriate inspection frequency. The AMP monitors and tracks *analysis assumptions controlling* the number of occurrences and severity of critical…
…appropriate inspection frequency through a fatigue crack growth evaluation. The AMP monitors and tracks the *analysis assumptions controlling* number of occurrences and severity of each of the critical thermal and pressure transients for the selected components that are used…

RESPONSE:

The staff did not agree with this comment. The staff did not incorporate the change to the program description of GALL-SLR Report AMP X.M1, “Fatigue Monitoring,” that was proposed in the comment. Specifically, the AMP assumes that the design assumptions for any fatigue or cyclical loading analysis in the program are valid for a subsequent period of extended operation. Thus, the program is directed at monitoring the cumulative number of design transient occurrences and the severity of those transients against the design assumptions for these transients in the analyses.

An SLR applicant does have the option of using the programmatic monitoring activities of its Fatigue Monitoring program to verify the continued of validity of the assumptions in the analyses, but that is not the main purpose of the AMP. Because the assumptions for monitoring or tracking design transients may be subject to specific Technical Specification (TS) requirements or design basis criteria in the FSAR, USAR, or UFSAR, any changes in design transient monitoring activities would need to be assessed against 10 CFR 50.59 requirements to determine if a 10 CFR 50.90 license amendment is required, or 10 CFR 50.71(e) FSAR update requirements, as applicable and related to the basis for monitoring the transients in the CLB.

Comment: **009**

X.M1 Element 1 Scope of Program – Page X.M1-3, second paragraph

Lines 9 -10 states: "This sample set includes the locations identified in NUREG/CR–6260 and additional plant-specific component locations in the reactor coolant pressure boundary if they may be more limiting than those considered in NUREG/CR–6260." Some locations in NUREG/CR–6260 may have projected CUF/CUFen << 0.5. If this is the case, a plant should not have to monitor an SC with projected 80-year CUF/ CUFen < 0.5.

Basis:

Continuously monitoring and updating detailed fatigue analyses for NUREG/CR-6260 locations that have projected 80-year CUF/ CUFen < 0.5 is not technically justified, while imposing additional costs on utilities for engineering analysis.

Markup

…This sample set includes the locations identified in NUREG/CR-6260 *with projected 80- year CUF/ CUFen ≥ 0.5,* and additional plant-specific component locations in the reactor coolant …

RESPONSE:

The staff did not agree with this comment. The staff did not incorporate the change of the AMP Scope of Program element as proposed in the comment. However, the staff did incorporate an additional clarification in the AMP Scope of Program element to address the comment.

Specifically, neither the NRC nor the AMP requires an applicant to perform continuous monitoring of design transient inputs to the CUF_{en} analyses that apply to specific reactor coolant pressure boundary locations or of the CUF_{en} analysis assumption criteria for these types of analyses. Thus, the commenter's statement that this is being required by the staff is not accurate.

In addition, the staff did not agree with the commenter's basis for using a CUF/CUF_{en} ratio value < 0.5 as a criterion basis to justify the commenter's proposed change to the referenced sentence in the AMP Scope of Program element. Specifically, if this ratio value criterion is used as the basis for changing the referenced sentence, it would mean that the CUF_{en} value for the component is more than twice the design basis CUF value for the same component. However, since this criterion is ratio-based, it would permit an applicant to avoid monitoring of the component locations even if the CUF or CUF_{en} values for the component were high (e.g., under the commenter's basis, an applicant would not need to monitor a component with a design basis CUF of 0.95 and a CUF_{en} value > 1.9). Thus, the staff considers the use of such a criterion could potentially result in a non-conservative monitoring basis. Therefore, the staff did not agree to use of this type of ratio-based criterion as a basis for defining which of the component locations in the environmentally-assisted fatigue calculations would need to be subject to the monitoring activities of the AMP.

However, based on the staff's efforts to resolve other comments made in regard to environmentally-assisted fatigue calculations (i.e., CUF_{en} calculations), the staff amended the second paragraph in the Scope of Program element for GALL-SLR Report AMP X.M1, "Fatigue Monitoring," to include additional criteria for the selection of components locations in CUF_{en} calculations and the type of regulatory bases that may be used to perform these CUF_{en} calculations. Specifically, the staff added the following additional sentences to the second paragraph of the Scope of Program element for AMP X.M1:

> "For the purposes of ascertaining the effects of the reactor water environment on fatigue, applicants include CUF_{en} calculations for a set of sample reactor coolant system components. This sample set includes the locations identified in NUREG/CR–6260 and additional plant-specific component locations in the reactor coolant pressure boundary if they may be more limiting than those considered in NUREG/CR–6260. Plant-specific justification can be provided to demonstrate that calculations for the NUREG/CR–6260 locations do not need to be included. Environmental effects on fatigue for these critical components may be evaluated using the guidance in RG 1.207, Revision 1; NUREG/CR–6909, Revision 0 (with "average temperature" used consistent with the clarification that was added to NUREG/CR–6909, Revision 1); or other subsequent NRC-endorsed alternatives. Component locations within the scope of this program are updated based on operating experience (OE), plant modifications, and inspection findings."

Comment: **010**

X.M1 Element 3 Parameters Monitored or Inspected–Page X.M1-3, third paragraph

Revise first sentence as indicated in markup.

Basis:

The current GALL-SLR sentence above should be revised as proposed above to more closely align it with GALL-SLR Revision 2. While "fatigue-significant" may have been intended by the Current GALL-SLR sentence, it is not certain as the phrase "contribute to fatigue" seems absolute. This interpretation would result in undue efforts on the utilities part to monitor transients that have a miniscule contribution to fatigue. Furthermore, it is not difficult to determine transient fatigue significance, as the pertinent information is readily available in most component fatigue evaluations.

Markup

The program monitors all applicable plant transients that cause cyclic strains and *are significant contributors* ~~contribute~~ to fatigue, as specified in the fatigue analyses, and *monitors or validates* appropriate environmental parameters that contribute to Fen values.

RESPONSE:

The staff partially agreed with this comment. The staff only incorporated part of the changes of the AMP Parameters Monitored or Inspected program element proposed in the comment.

The staff did not agree with the proposed change to the first clause in the referenced sentence of the program element but did accept the proposed change to the second clause in the sentence.

The staff made a minor, non-substantive edit of the second clause in the referenced sentence because the staff did not agree that the AMPs monitoring activities should be limited only to design transients that are significant contributors to the fatigue calculations.

Specifically, this matter was discussed during public meeting related to SLR in April 26, 2016. To reiterate points made to the industry members during the public meeting, staff agreed that technical arguments could be made for eliminating cycle count monitoring of those transients that do not significantly contribute to fatigue usage (i.e., to the CUF value) for monitored components. However, the staff also informed the industry that there could be regulatory or legal bases in the CLBs that would prevent an applicant from adopting this practice. For example, the staff informed the industry that, for Class 1 components with CUF analyses, the Administrative Controls in the TS may require them to monitor specific operational transients for the components that are defined in particular sections or tables of the FSAR (or UFSAR or USAR) or alternatively, in a plant's Technical Requirements Manual (TRM), as controlled by the administrative controls section of the TS. Thus, for transients covered by the TS requirements, the TS could require monitoring of a given transient, even if it was a small contributor to the CUF results.

The staff also pointed out to industry that, for components with high but acceptable CUF values, even a transient that provides a small contribution to the overall value for the CUF calculation could have a significant effect if it were to exceed the number of cycles assumed for the transient in the CUF calculation. Thus, the staff did not agree that the program should be limited only to the monitoring of design transients that are high contributors to the fatigue calculations.

However, given the staff's acceptance of NEI's proposed change to the second clause in the sentence, the staff amended the first sentence in the Parameters Monitored or Inspected program element of GALL-SLR Report AMP X.M1, "Fatigue Monitoring," so that the sentence would incorporate NEI's proposed change to the second referenced clause in the sentence; the referenced sentence now states:

> "The program monitors all applicable plant transients that cause cyclic strains and contribute to fatigue, as specified in the fatigue analyses, and monitors or validates appropriate environmental parameters that contribute to F_{en} values."

<u>Comment</u>: <u>011</u>

X.M1 Element 3 Parameters Monitored or Inspected–Page X.M1-3, third paragraph

Lines 18-20 states for the Element 3, Parameters Monitored of Inspected, "actual plant water chemistry that contribute to the fatigue analyses for each component are monitored". This program should not have actual plant water chemistry as a parameter monitored. A similar change should be made to the other elements which impose the plant water chemistry monitoring requirement.

Basis:

As stated on page X.M1-2, "this program relies on…. AMP XI.M2, "Water Chemistry," to provide monitoring of appropriate environmental parameters". Therefore, if Water Chemistry AMP is credited then all monitoring should be in the Water Chemistry AMP not in the Cyclic Load Monitoring AMP.

Source 016

Markup

…analyses, and *monitors or validates the* appropriate environmental parameters that contribute to Fen values. The number of occurrences~~,~~ ***and*** the severity of the plant transients, ~~*and actual plant water chemistry*~~ that contribute to the fatigue analyses for each component are monitored. More detailed monitoring of pressure~~,~~ ***and*** thermal conditions~~*, and water chemistry*~~ at the component location may be performed to allow the fatigue analyses to be assessed for the specified critical locations.

RESPONSE:

The staff partially agreed with this comment. The staff agreed to modify the second and third sentences in the Parameters Monitored or Inspected program element of GALL-SLR Report AMP X.M1, "Fatigue Monitoring," but in a manner that was slightly different from the changes proposed in the comment.

Contrary to implications suggested in the comment, the program element criteria in GALL-SLR Report AMP X.M1 do not constitute regulatory requirements that a licensee of a U.S. nuclear plant would be required to follow. Instead, the AMP provides an acceptable method that may be adopted by a license renewal applicant to accept fatigue or cyclical loading analyses in accordance with the regulatory acceptance criterion for TLAAs in 10 CFR 54.21(c)(1)(iii) and to manage cumulative fatigue damage or cracking induced by fatigue or cyclic loading in the structures or components during a proposed subsequent period of extended operation.

However, the staff agreed with the comment that the monitoring of any water chemistry parameters that factor into the methodologies for performing environmentally-assisted fatigue calculations (i.e. CUF_{en} calculations) could be done by alternative means, such through implementation of the applicant's AMP that corresponds to GALL-SLR Report AMP XI.M2, "Water Chemistry," in NUREG–2191. Thus, the staff decided to break the second sentence of the Parameters Monitored or Inspected program element of AMP X.M1 into two sentences that would address the comments, but decided to keep the third sentence in this program element as written in the draft version of the AMP in NUREG–2191. Thus, to address this comment, the Parameters Monitored or Inspected program element of GALL-SLR AMP X.M1 now states:

> "The program monitors all applicable plant transients that cause cyclic strains and contribute to fatigue, as specified in the fatigue analyses, and monitors or validates appropriate environmental parameters that contribute to F_{en} values. The number of occurrences and the severity of the plant transients that contribute to the fatigue analyses for each component are monitored. For environmentally-assisted fatigue calculations, chemistry parameters that provide inputs to F_{en} factors used in CUF_{en} calculations are monitored and tracked in accordance with this program or alternatively through implementation of the applicant's water chemistry program. More detailed monitoring of pressure, thermal, and water chemistry conditions at the component location may be performed to allow the fatigue analyses to be assessed for the specified critical locations."

Comment: 012

X.M1 Element 4 Detection of Aging Effects–Page X.M1-3, fourth paragraph

Revise first sentence as indicated in the markup.

Basis:

The current GALL-SLR sentence should be revised as proposed to more closely align it with the program description section of the AMP, paragraph 3, which clearly allows for the monitoring of plant operating conditions.

Markup

The program uses applicant defined activities or methods to track the number of occurrences and severity of transients~~, and water chemistry~~ conditions, *and any applicable plant operating conditions used to inform updated evaluations of the fatigue analyses.*

RESPONSE:

The staff partially agree with this comment. The staff agreed to modify the Detection of Aging Effects program element in GALL-SLR Report AMP X.M1, "Fatigue Monitoring," but used wording that is slightly different from the change of the AMP program element proposed in the comment.

Specifically, the staff agreed with the proposed change to the first sentence in the Detection of Aging Effects program element of the AMP, but coupled this with an additional sentence that incorporated the staff's basis for resolving the previous Comment 016-011 on AMP X.M1. The additional sentence permits an applicant to monitor water chemistry parameter inputs used in environmentally-assisted fatigue (CUF_{en}) calculations using either the monitoring activities of the applicant's Fatigue Monitoring Program or those for the applicant's Water Chemistry Program (refer to GALL-SLR AMP XI.M2, "Water Chemistry"). Therefore, the staff amended the Detection of Aging Effects program element in AMP X.M1 so that it now reads:

> "The program uses applicant defined activities or methods to track the number of occurrences and severity of design basis transient conditions, and any applicable plant operating conditions used to inform updated evaluations of the fatigue analyses. Monitoring of water chemistry parameters that are inputs to environmentally-assisted fatigue calculations may be performed in accordance with the implementation of this AMP or an applicant's Water Chemistry Program. Technical specification requirements may apply to these activities."

Comment: 013

X.M1 Element 5 Monitoring and Trending–Page X.M1-3, fifth paragraph

Add the sentence in the markup for clarification.

Source 016

Basis:

The current GALL-SLR sentence above should be revised as proposed to more closely align it the program description section of the AMP, paragraph 3, which clearly allows for the monitoring of plant operating conditions.

Markup

~~*Monitoring of water chemistry conditions is used to ensure calculated Fen values remain valid.*~~ *Monitoring of actual plant operating conditions is used to inform updated evaluations of the fatigue analyses to ensure they continue to meet the design or analysis-specific limit.* Trending is performed to ensure that the fatigue analyses are…

RESPONSE:

The staff partially agreed with this comment. The staff agreed to modify the Monitoring and Trending program element in GALL-SLR Report AMP X.M1, "Fatigue Monitoring," but using wording that was slightly different from the change of the AMP program element proposed in the comment.

The staff agreed that the main objective of the Fatigue Monitoring program is to monitor and trend the appropriate plant parameters and conditions that factor into the various types of fatigue or cyclical loading analyses that the AMP may be applied to. Therefore, in order to be consistent with the staff's basis for amending Element 4, Detection of Aging Effects, in response to the commenter's 12th comment on this AMP, the monitoring and trending of water chemistry parameters may be done in accordance with an applicant's Fatigue Monitoring program, or alternatively through implementation of the AMP that corresponds to GALL-SLR AMP XI.M2, "Water Chemistry."

Therefore, to resolve this comment, the staff amended the Monitoring and Trending program element in AMP X.M1 to make the following statements:

> "Monitoring and trending of the number of occurrences of each of the transient cycles and their severity is used to track the occurrences of all transients needed to ensure the continued acceptability of the fatigue analyses, or to update the analyses. Monitoring of plant operating conditions or water chemistry parameter conditions (i.e., as inputs for components with stress-based fatigue calculations or environmental fatigue calculations) is used to either verify the validity of the evaluations against their applicable design limits or else to update the evaluations, when necessary, of the fatigue analyses to ensure they continue to meet the design or analysis-specific limit. Trending is performed to ensure that the fatigue analyses are managed and that the fatigue parameter limits will not be exceeded during the subsequent period of extended operation, thus minimizing the possibility of fatigue crack initiation of metal components caused by cyclic strains or water chemistry conditions. The program provides for revisions to the fatigue analyses or other corrective actions (e.g., revising augmented inspection frequencies) on an as-needed basis, if the values assumed for fatigue parameters are approached, transient severities exceed the design or assumed severities, transient counts exceed the design or assumed quantities, transient definitions have changed, unanticipated new fatigue loading events are discovered, or the geometries of components are modified."

<u>Comment</u>: <u>014</u>

X.M1 Element 10 Operating Experience – Page X.M1-4 Lines 37-40

Lines 38-40 discuss the concerns in RIS 2011-14 regarding implementation of software programs to calculate fatigue usage “during plant transient associated with plant transient operations”. This should be revised to say “in analyses of plant transients”.

Basis:

RIS 2011-14 states the concern to be analyst intervention into software programs which perform analyses. The way this is worded could infer the issue was with the use of WESTEMS for fatigue monitoring, which is not the case. WESTEMS used for monitoring does not afford analyst intervention in this manner.

<u>Markup</u>

…is recommended, if such a methodology is used. Furthermore, as discussed in NRC RIS 2011–14, the staff has identified concerns regarding the implementation of computer software packages used to calculate fatigue usage ~~*during plant transient*~~ associated with plant transient operations.

RESPONSE:

The staff agreed with this comment. The staff incorporated the proposed change to the Operating Experience program element in GALL-SLR Report AMP X.M1, “Fatigue Monitoring,” as proposed in the comment.

The staff considered the proposed change to be acceptable. The last sentence in the first paragraph of the Operating Experience program element for AMP X.M1 has been amended to state:

> “Furthermore, as discussed in NRC RIS 2011–14, the staff has identified concerns regarding the implementation of computer software packages used to calculate fatigue usage associated with plant transient operations.”

<u>Comment</u>: <u>015</u>

X.M1 Table X-02 Section 4.3–Page X02-2,3

Table X-02 requires that CUFen needs to be re-assessed as acceptable before the SLR application, rather than before entry into SLR period, and it specifies that the number of transients be projected and the TLAA is acceptable. This is not necessarily compatible with stress-based monitoring. An alternative should be included that permits the use of CUF projections based on stress-based CUF values computed over time using stress-based fatigue monitoring. The table also appears duplicative between some sections.

Source 016

Basis:

The purpose of computing the 80-year CUF_{en} values is to demonstrate the components should be able to satisfactorily withstand the transient cycles expected to occur through the subsequent period of extended operation, based on past rates of transient occurrence. This objective may also be achieved by making projections of the CUF values and CUF_{en} values periodically computed using stress-based fatigue monitoring. The 80-year CUF and CUF_{en} projections would also provide assurance that the components can withstand the transient cycles expected to occur through the subsequent period of extended operation, based on past rates of CUF and CUF_{en} accumulation. This would be more accurate since the actual transient severities are monitored, which more closely relates to actual fatigue accumulation.

RESPONSE:

The staff agreed with this comment. The staff incorporated the change to GALL-SLR Report, Table X-01, as proposed in the comment. Therefore, the staff amended the FSAR supplement example for AMP X.M1, "Fatigue Monitoring," in SRP-SLR Table X-01, such that it now reads:

> "This program is used to accept fatigue or other types of cyclical loading TLAAs in accordance with the acceptance criterion in 10 CFR 54.21(c)(1)(iii). The aging management program monitors and tracks the number of occurrences and severity of design basis transients assessed in the applicable fatigue or cyclical loading analyses, including those in applicable CUF analyses, environmental-assisted fatigue analyses (CUF_{en} analyses), maximum allowable stress range reduction/expansion stress 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 also monitors applicable design transient parameters (e.g., temperatures, pressures, displacements, strains, flow rates, etc.) for components with stress-based fatigue calculations.
>
> The program manages cumulative fatigue damage or cracking induced by fatigue or cyclic loading in the applicable structures and components through performance of activities that monitor one or more relevant analysis parameters, such as CUF values, CUF_{en} values, design transient cycle limit values, predicted flaw size values, or plant-specific parameter values used in stress-based fatigue analysis methodologies. The program also sets applicable acceptance criteria (limits) on these parameters. Therefore, the program has two aspects, one to verify the continued acceptability of existing analyses through cycle counting or parameter monitoring and the other to provide periodically updated evaluations of the analyses to demonstrate that they continue to meet the appropriate limits.
>
> The program also implements appropriate corrective actions (e.g., reanalysis, component or structure inspections, or component or structure repair or replacement activities) when acceptance limits are approached. Plant technical specification requirements may apply to the scope of this program."

<u>Comment</u>: <u>016</u>

X.M1 Table X-02 Section 4.3 – Page X02-2,3,6

The title of Table X-02 reads "Aging Management Programs Discussed in SRP-SLR Chapter 4" but there are no "Aging Management Programs Discussed in SRP-SLR Chapter 4;" rather, this Section 4 discusses TLAAs. The associated FSAR Supplements in our LRAs merely refer to AMPs (as needed for disposition of the TLAA); it does not contain the AMPs. Thus, the table needs a new title and the column for "Implementation Schedule" should be deleted–this could be confusing to the reader.

The "Completed" entries merely mean that NRC expects that the TLAA can be dispositioned using (i) or (ii); once again, there is no need for this column.

These examples of standard text for the "Evaluation of TLAAs" can only be used as examples, not for verbatim compliance; just like the SLR-SRP says for Table 3.0-1: Table 3.0-1 of this SRP-SLR provides examples of the type of information to be included in the FSAR Supplement. This must be clarified somewhere.

If Table X-02 is retained, then it should be moved to the SLR-SRP NUREG–2192, similar to Table 3.0-1.

The highlighted sentence at the bottom of Table X-02 should be deleted; there is no need to impose a license condition instead of a licensing commitment:

*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 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 by no later than the committed date.*

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made.

The previous title of the Chapter X title page, as given in NUREG–1801, Revision 2, was improperly misleading interested parties that the GALL chapter was providing a list of TLAAs and the guidance for those TLAAs, which was not true. Instead, Chapter X in the staff's GALL documents has always provided a list of those AMPs (and the program element criteria for the AMPs) that are commonly used to demonstrate the acceptance of generic TLAAs or even some plant-specific TLAAs in accordance with 10 CFR 54.21(c)(1)(iii). The TLAAs that correlate to the AMPs listed in Chapter X of the GALL-SLR Report are given in either SRP-SLR Chapters 4.2, 4.3, 4.4, 4.6, or 4.7.

Therefore, the staff reformatted the title of GALL-SLR Report Chapter X to rename it "Aging Management Programs Used to Demonstrate the Acceptability of Time-Limited Aging Analyses Under 10 CFR 54.21(c)(1)(iii)." Like the AMPs defined in GALL-SLR Report, Chapter XI, the AMPs in Chapter X are defined in terms of the 10 program elements that are recommended for AMPs in Appendix A.1 of the SRP-SLR. The renamed title should correct any further misconception by members of the industry or members of the public that GALL-SLR Report Chapter X is providing a list of TLAAs.

The staff also deleted Table X-02 from the scope of Chapter X in the GALL-SLR Report. Instead, the FSAR supplement summary description examples for generic TLAAs identified in the SRP-SLR are found in SRP-SLR Tables 4.2-1, 4.3-1, 4.4-1, 4.5-1, and 4.6-1.

Comment: 017

X.M1 Program Editorial Comments

The markup provided by this comment was for the entire program in GALL-SLR Report AMP X.M1 included in pages 9 – 13 of Attachment 3 in the NEI comment letter of February 29, 2016 (ADAMS Accession No. ML16069A068).

RESPONSE:

The markup provided by NEI in Comment 016-017 represent the collective set of markups proposed by Comments 016-001 through 016-016 on GALL-SLR Report AMP X.M1, "Fatigue Monitoring," as given in Attachment 3 of the NEI letter of February 29, 2017 (ADAMS Accession No. ML16069A068). The staff made some corresponding changes to the program description and program elements of the AMP based on receipt and review of these comments, and the bases for implementing changes to the AMP have been discussed in the staff's individual bases for resolving these comments, as given in the preceding comment responses.

Comment: 018

X.M2 Program Description - Page X.M2-1

The program description begins by saying this program provides an acceptable basis for managing neutron fluence-based TLAAs. This statement runs counter to the license renewal rule that provides for managing the effects of aging, but not for managing TLAAs.

Basis:

The rule specifies that TLAAs are evaluated; not managed. The second paragraph repeats the thought that this program manages neutron embrittlement TLAAs. The program should be described as what it is, that is, a program to determine the time-limited assumptions involved in the neutron fluence-based TLAAs.

Markup

This ~~*aging management*~~ program *ensures the validity of the neutron fluence inputs into the* ~~*(AMP) provides an acceptable basis for managing*~~ neutron fluence-based time-limited aging analysis (TLAAs) ~~*in accordance with requirements in 10 CFR 54.21(c)(1)(iii)*~~. This program monitors neutron fluence for reactor pressure vessel (RPV) components and reactor vessel internal (RVI) components and is used in conjunction with the ~~*guidance in*~~ Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) AMP XI.M31, "Reactor Vessel Surveillance." Neutron fluence is a time-dependent input parameter for evaluating the loss of fracture toughness due to neutron irradiation embrittlement. Accurate neutron fluence values are also necessary to identify the ~~*location of the*~~ RPV beltline *materials* ~~*region*~~ for which neutron fluence is projected to exceed 1×10^{17} n/cm^2 (E > 1 MeV) during the subsequent period of extended operation.

~~*The assessment of*~~ *N*eutron fluence is an input to a number of RPV irradiation embrittlement analyses that are mandated by specific regulations in 10 CFR Part 50. These analyses are TLAAs for ~~*subsequent*~~ license renewal applications (SLRAs) and are the topic of the acceptance criteria and review procedures in Standard Review Plan for Subsequent License Renewal (SRP-SLR) Section 4.2, “Reactor Vessel Neutron Embrittlement Analyses.” The neutron irradiation embrittlement TLAAs that are *validated* ~~*managed*~~ by this AMP include, but are not limited to: ~~*(a) neutron fluence,*~~ (b) pressurized thermal shock (PTS) analyses for ….

Guidance on acceptable methods and assumptions for determining reactor vessel neutron fluence is ~~*described*~~ in the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.190, “Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence.” The methods developed and approved using the guidance ~~*contained*~~ in RG 1.190 are specifically intended *for determining* ~~*to calculate*~~ neutron fluence in the region of the RPV close to the active fuel region of the core and are not intended to apply to vessel regions significantly above and below the active fuel region of the core, nor to RVI components. ~~*Therefore, the use of RG 1.190-adherent methods to estimate neutron fluence for the RPV regions significantly above and below the active fuel region of the core and RVI components may require additional justification, even if those methods were approved by the NRC for RPV neutron fluence calculations.*~~ This program monitors in-vessel or ex-vessel dosimetry capsules and evaluates the dosimetry data, as needed. ~~*The implementation of*~~ *S*uch dosimetry capsules may be needed when the reactor surveillance program has exhausted the available capsules for in-vessel exposure.

RESPONSE:

The staff partially agreed with this comment. The staff incorporated some of the changes to the first, second, and fourth paragraphs of the program description in GALL-SLR Report AMP X.M2, “Neutron Fluence Monitoring,” as proposed in the comment.

It is true that the regulation 10 CFR 54.21(a)(3) requires a license renewal applicant to manage all aging effects that are attributed to components scoped in for renewal under the requirements of 10 CFR 54.4 and screened in for renewal under the requirements in 10 CFR 54.21(a)(1). However, the license renewal rule does not limit the means for managing aging effects only to aging management programs or activities; an applicant also may manage aging using applicable TLAAs. In fact, some AMR items in the GALL-SLR and SRP-SLR reports use a TLAA-basis as the sole basis for managing the aging effects stated in the aging management review (AMR) items.

It is also true that 10 CFR 54.21(c)(1) requires all analyses conforming to the definition of a TLAA to be evaluated as part of an LRA, and to demonstrate the acceptance of these TLAAs in accordance with one of three designated acceptance standards for TLAAs, as defined in 10 CFR 54.21(c)(1)(i), (ii), or (iii). One of the six criteria in 10 CFR 54.3(a) for defining a given analysis, calculation or evaluation as a TLAA is that the analysis, calculation or evaluation has to involve an assessment of a given aging effect. If an applicant uses 10 CFR 54.21(c)(1)(iii) as the basis for demonstrating acceptability of a TLAA, the applicant must demonstrate that the aging effect analyzed in the TLAA will be adequately managed during the period of extended operation. Thus, an applicant may use a TLAA as one method to manage a specific aging effect under the requirements of 10 CFR 54.21(a)(3) and then specify the use of a specific AMP or aging management activity to demonstrate acceptance of the TLAA under the criterion

10 CFR 54.21(c)(1)(iii), such impacts of the specific aging effect evaluated in the TLAA on the intended functions of the components will be adequately managed during the period of extended operation. Thus, the applicant's argument that aging effects in TLAAs are not managed is not valid.

Hence, the staff determined that some of the proposed changes of the AMP's program description were acceptable for incorporation into the AMP, but not all of them. Specific language pertaining to the location of the reactor pressure vessel (RPV) "beltline" region was selected in accordance with clarification provided in RIS 2014-11, "Information on Licensing Applications for Fracture Toughness Requirements for Ferritic Reactor Coolant Pressure Boundary Components." The NRC staff also did not strike "neutron fluence" from the list of TLAAs that fall within the AMP because the treatment or assessment of fluence may need to be defined as a TLAA in the SLRA, particularly if treatment or assessment of neutron fluence is determined to meet all six of the criteria for defining TLAAs in 10 CFR 54.3(a). The NRC staff also did not strike the clause discussing the use of RG 1.190-adherent methods for estimating the fluence levels for RPV regions above and below the active fuel region, or for reactor vessel internal (RVI) components, because not all of the provisions in RG 1.190 are applicable to RVI components or to RPV components located above or below the active reactor core region in the RPV.

Based on partial acceptance of the proposed changes to the program description of GALL-SLR Report AMP X.M2, the staff amended the first paragraph of the program description such that it now states:

> "This aging management program (AMP) ensures the validity of the neutron fluence analysis and related, neutron fluence-based, time-limited aging analyses (TLAAs). In so doing, this AMP also provides an acceptable basis for managing aging effects attributable to neutron fluence in accordance with requirements in Title 10 of the Code of Federal Regulations (10 CFR) 54.21(c)(1)(iii). This program monitors neutron fluence for reactor pressure vessel (RPV) components and reactor vessel internal (RVI) components and is used in conjunction with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) AMP XI.M31, "Reactor Vessel Surveillance." Neutron fluence is a time-dependent input parameter for evaluating the loss of fracture toughness due to neutron irradiation embrittlement. Accurate neutron fluence values are also necessary to identify the RPV beltline region for which neutron fluence is projected to exceed 1×10^{17} n/cm^2 (E > 1 MeV) during the subsequent period of extended operation."

Based on partial acceptance of the proposed changes to the program description of GALL-SLR Report AMP X.M2, the staff amended the second paragraph of the program description such that it now states:

> "Neutron fluence is an input to a number of RPV irradiation embrittlement analyses that are mandated by specific regulations in 10 CFR Part 50. These analyses are TLAAs for subsequent license renewal applications (SLRAs) and are the topic of the acceptance criteria and review procedures in Standard Review Plan for Subsequent License Renewal (SRP-SLR) Section 4.2, "Reactor Vessel Neutron Embrittlement Analyses." The neutron irradiation embrittlement TLAAs that are within the scope of this AMP include, but are not limited to: (a) neutron fluence, (b) pressurized thermal shock analyses for pressurized water reactors, as mandated by 10 CFR 50.61 or alternatively [if applicable for the current licensing basis (CLB)] by 10 CFR 50.61a; (c) RPV upper-shelf energy analyses, as mandated by Section IV.A.1 of

> 10 CFR Part 50, Appendix G, and (d) pressure-temperature (P-T) limit analyses that are mandated by Section IV.A.2 of 10 CFR Part 50, Appendix G and controlled by plant Technical Specifications (TS) update and reporting requirements (i.e., the 10 CFR 50.90 license amendment process for updates of P-T limit curves located in the TS limiting conditions of operation, or TS administrative control section requirements for updates of P-T limit curves that have been relocated into a pressure-temperature limits report."

Based on partial acceptance of the proposed changes to the program description of GALL-SLR Report AMP X.M2, the staff amended the fourth paragraph of the program description such that it now states:

> "Guidance on acceptable methods and assumptions for determining reactor vessel neutron fluence is described in the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." The methods developed and approved using the guidance contained in RG 1.190 are specifically intended for determining neutron fluence in the region of the RPV close to the active fuel region of the core and are not intended to apply to vessel regions significantly above and below the active fuel region of the core, nor to RVI components. Therefore, the use of RG 1.190-adherent methods to estimate neutron fluence for the RPV regions significantly above and below the active fuel region of the core and RVI components may require additional justification, even if those methods were approved by the NRC for RPV neutron fluence calculations. This program monitors in-vessel or ex-vessel dosimetry capsules and evaluates the dosimetry data, as needed. Such dosimetry capsules may be needed when the reactor surveillance program has exhausted the available capsules for in-vessel exposure."

Comment: 019

X.M2 Program Description - Page X.M2-1

Add close paraphrases to end of last sentence in second paragraph.

Basis:

Editorial

Markup

…. The neutron irradiation embrittlement TLAAs that are managed by this AMP

…. have been relocated into a pressure-temperature limits report (PTLR)**)**.

RESPONSE:

The staff accepted this comment. In this comment, the commenter identified a typographical error in the program description of AMP X.M2, "Neutron Fluence Monitoring," which the staff fixed by deleting the referenced parenthetical abbreviation that was previously included in the sentence. The reference sentence now reads:

Source 016

"*The neutron irradiation embrittlement TLAAs that are managed by this AMP. . .. P-T limit curves that have been relocated into a pressure-temperature limits report*."

Comment: 020

X.M2 Program Description - Page X.M2-1, Lines 10-12

Lines 10-12 states, "Accurate neutron fluence values are also necessary to identify the location of the RPV beltline region for which neutron fluence is projected to exceed 1 x 10^{17} n/cm² (E>1 MeV) during the subsequent period of extended operation." A similar "generic" fluence threshold acceptable to NRC is needed to determine the areas where RVI components are susceptible to Irradiation Assisted Stress Corrosion Cracking (IASCC) so that appropriate inspections are performed and inspection frequencies determined. As described in BWRVIP-26-A, "The threshold fluence level for IASCC has been estimated to be ~5 × 10^{20} n/cm² (E>1 MeV). Therefore this value should be identified as the accepted neutron fluence threshold for IASCC. Since this is an NRC approved document, is this the accepted neutron fluence threshold for IASCC?

Basis:

Without an NRC accepted threshold for IASCC within the context of the neutron fluence monitoring, a significant cost for possible unnecessary and frequent inspections of components could be realized during the 60 – 80 year period. In particular, regions above and below existing Top Guide, Core Shroud, Jet Pump and RPV Attachment weld locations, which typically within the active core region, but may extend similar to the "extended" beltline region.

Markup

…Accurate neutron fluence values are also necessary to identify the location of the RPV beltline region for which neutron fluence is projected to exceed 1 × 10^{17} n/cm² (E > 1 MeV) during the subsequent period of extended operation. *Additionally, accurate neutron fluence values are necessary to identify the location of RVI components susceptible to Irradiation Assisted Stress Corrosion Cracking (IASCC) for which neutron fluence is projected to exceed 5×10^{20} n/cm² (E>1 MeV) during the subsequent period of extended operation.*

RESPONSE:

The staff did not accept this comment. The staff did not amend the program description to include the commenter's proposed sentence at the end of the first paragraph of the program description in AMP X.M2, "Neutron Fluence Monitoring."

The staff acknowledges that it has accepted fluence-based thresholds for initiating IASCC or other radiation-induced aging mechanisms in stainless steel or nickel alloy RVI components on an application-specific basis. However, there may be some variance in the stated thresholds for these aging mechanisms in different industry reports or literature on aging. For example, the threshold stated for initiating IASCC of stainless steel materials in EPRI BWRVIP Technical Report No. BWRVIP-26-A, as cited by the commenter, may be slightly different from the value reported for these materials in the EPRI MRP background reports used for development of EPRI Technical Report No. MRP-227-A. Thus, the staff would expect an applicant to base its considerations on the bounding fluence assumptions used a specific report and the respective applicability of the report to the design basis of the plant being evaluated.

In addition, thresholds set by the industry to date have typically been based on an assessment of accumulated fluence levels over a cumulative 60-year operating life, and have not been updated for 80 years of cumulative operation. As such, it would not be appropriate for the staff to cite specific fluence threshold values in GALL-SLR AMP X.M2 due to the fact that the industry could potentially change their cited threshold values, particularly if the industry were to perform updated 80-year studies of RVI components in order to support future submittals of subsequent license renewal applications.

Comment: 018

X.M2 Program Description - Page X.M2-1

The program description begins by saying this program provides an acceptable basis for managing neutron fluence-based TLAAs. This statement runs counter to the license renewal rule that provides for managing the effects of aging, but not for managing TLAAs.

Basis:

The rule specifies that TLAAs are evaluated; not managed. The second paragraph repeats the thought that this program manages neutron embrittlement TLAAs. The program should be described as what it is, that is, a program to determine the time-limited assumptions involved in the neutron fluence-based TLAAs.

Markup

This ~~aging management~~ program *ensures the validity of the neutron fluence inputs into the* ~~*(AMP) provides an acceptable basis for managing*~~ neutron fluence-based time-limited aging analysis (TLAAs) ~~*in accordance with requirements in 10 CFR 54.21(c)(1)(iii)*~~. This program monitors neutron fluence for reactor pressure vessel (RPV) components and reactor vessel internal (RVI) components and is used in conjunction with the ~~*guidance in*~~ Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) AMP XI.M31, “Reactor Vessel Surveillance.” Neutron fluence is a time-dependent input parameter for evaluating the loss of fracture toughness due to neutron irradiation embrittlement. Accurate neutron fluence values are also necessary to identify the ~~*location of the*~~ RPV beltline *materials* ~~*region*~~ for which neutron fluence is projected to exceed 1×10^{17} n/cm^2 (E > 1 MeV) during the subsequent period of extended operation.

~~*The assessment of*~~ Neutron fluence is an input to a number of RPV irradiation embrittlement analyses that are mandated by specific regulations in 10 CFR Part 50. These analyses are TLAAs for ~~*subsequent*~~ license renewal applications (SLRAs) and are the topic of the acceptance criteria and review procedures in Standard Review Plan for Subsequent License Renewal (SRP-SLR) Section 4.2, “Reactor Vessel Neutron Embrittlement Analyses.” The neutron irradiation embrittlement TLAAs that are *validated* ~~*managed*~~ by this AMP include, but are not limited to: ~~*(a) neutron fluence,*~~ (b) pressurized thermal shock (PTS) analyses for ….

Guidance on acceptable methods and assumptions for determining reactor vessel neutron fluence is ~~*described*~~ in the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.190, “Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence.” The methods developed and approved using the guidance ~~*contained*~~ in RG 1.190 are specifically intended *for determining* ~~*to calculate*~~ neutron fluence in the region of the RPV close to the active fuel region of the core and are not intended to apply to vessel regions significantly above and below the active fuel region of the core, nor to RVI components. ~~*Therefore, the use of RG 1.190*~~

~~*adherent methods to estimate neutron fluence for the RPV regions significantly above and below the active fuel region of the core and RVI components may require additional justification, even if those methods were approved by the NRC for RPV neutron fluence calculations.*~~ This program monitors in-vessel or ex-vessel dosimetry capsules and evaluates the dosimetry data, as needed. ~~*The implementation of*~~ *S*uch dosimetry capsules may be needed when the reactor surveillance program has exhausted the available capsules for in-vessel exposure.

RESPONSE:

The staff partially agreed with this comment. The staff incorporated some of the changes to the first, second, and fourth paragraphs of the program description in GALL-SLR Report AMP X.M2, “Neutron Fluence Monitoring,” as proposed in the comment.

It is true that the regulation 10 CFR 54.21(a)(3) requires a license renewal applicant to manage all aging effects that are attributed to components scoped in for renewal under the requirements of 10 CFR 54.4 and screened in for renewal under the requirements in 10 CFR 54.21(a)(1). However, the license renewal rule does not limit the means for managing aging effects only to aging management programs or activities; an applicant also may manage aging using applicable TLAAs. In fact, some AMR items in the GALL-SLR and SRP-SLR reports use a TLAA-basis as the sole basis for managing the aging effects stated in the AMR items.

It is also true that the requirements in 10 CFR 54.21(c)(1) requires all analyses conforming to the definition of a TLAA to be evaluated as part of an LRA, and to demonstrate the acceptance of these TLAAs in accordance with one of three designated acceptance standards for TLAAs, as defined in 10 CFR 54.21(c)(1)(i), (ii), or (iii). One of the six criteria in 10 CFR 54.3(a) for defining a given analysis, calculation or evaluation as a TLAA is that the analysis, calculation or evaluation has to involve an assessment of a given aging effect. If an applicant uses 10 CFR 54.21(c)(1)(iii) as the basis for demonstrating acceptability of a TLAA, the applicant must demonstrate that the aging effect analyzed in the TLAA will be adequately managed during the period of extended operation. Thus, an applicant may use a TLAA as one method to manage a specific aging effect under the requirements of 10 CFR 54.21(a)(3) and then specify the use of a specific AMP or aging management activity to demonstrate acceptance of the TLAA under the criterion 10 CFR 54.21(c)(1)(iii), such impacts of the specific aging effect evaluated in the TLAA on the intended functions of the components will be adequately managed during the period of extended operation. Thus, the applicant’s argument that aging effects in TLAAs are not managed is not valid.

Hence, the staff determined that some of the proposed changes of the AMP’s program description were acceptable for incorporation into the AMP, but not all of them. Specific language pertaining to the location of the RPV “beltline” region was selected in accordance with clarification provided in RIS 2014-11, “Information on Licensing Applications for Fracture Toughness Requirements for Ferritic Reactor Coolant Pressure Boundary Components.” The NRC staff also did not strike “neutron fluence” from the list of TLAAs that fall within the AMP because the treatment or assessment of fluence may need to be defined as a TLAA in the SLRA, particularly if treatment or assessment of neutron fluence is determined to meet all six of the criteria for defining TLAAs in 10 CFR 54.3(a). The NRC staff also did not strike the clause discussing the use of RG 1.190-adherent methods for estimating the fluence levels for RPV regions above and below the active fuel region, or for RVI components, because not all of the provisions in RG 1.190 are applicable to RVI components or to RPV components located above or below the active reactor core region in the RPV.

Based on partial acceptance of the proposed changes to the program description of GALL-SLR Report AMP X.M2, the staff amended the first paragraph of the program description such that it now states:

> "This aging management program (AMP) ensures the validity of the neutron fluence analysis and related, neutron fluence-based, time-limited aging analyses (TLAAs). In so doing, this AMP also provides an acceptable basis for managing aging effects attributable to neutron fluence in accordance with requirements in Title 10 of the Code of Federal Regulations (10 CFR) 54.21(c)(1)(iii). This program monitors neutron fluence for reactor pressure vessel (RPV) components and reactor vessel internal (RVI) components and is used in conjunction with the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) AMP XI.M31, "Reactor Vessel Surveillance." Neutron fluence is a time-dependent input parameter for evaluating the loss of fracture toughness due to neutron irradiation embrittlement. Accurate neutron fluence values are also necessary to identify the RPV beltline region for which neutron fluence is projected to exceed 1×10^{17} n/cm^2 (E > 1 MeV) during the subsequent period of extended operation."

Based on partial acceptance of the proposed changes to the program description of GALL-SLR Report AMP X.M2, the staff amended the second paragraph of the program description such that it now states:

> "Neutron fluence is an input to a number of RPV irradiation embrittlement analyses that are mandated by specific regulations in 10 CFR Part 50. These analyses are TLAAs for subsequent license renewal applications (SLRAs) and are the topic of the acceptance criteria and review procedures in Standard Review Plan for Subsequent License Renewal (SRP-SLR) Section 4.2, "Reactor Vessel Neutron Embrittlement Analyses." The neutron irradiation embrittlement TLAAs that are within the scope of this AMP include, but are not limited to: (a) neutron fluence, (b) pressurized thermal shock analyses for pressurized water reactors, as mandated by 10 CFR 50.61 or alternatively [if applicable for the current licensing basis (CLB)] by 10 CFR 50.61a; (c) RPV upper-shelf energy analyses, as mandated by Section IV.A.1 of 10 CFR Part 50, Appendix G, and (d) pressure-temperature (P-T) limit analyses that are mandated by Section IV.A.2 of 10 CFR Part 50, Appendix G and controlled by plant Technical Specifications (TS) update and reporting requirements (i.e., the 10 CFR 50.90 license amendment process for updates of P-T limit curves located in the TS limiting conditions of operation, or TS administrative control section requirements for updates of P-T limit curves that have been relocated into a pressure-temperature limits report."

Based on partial acceptance of the proposed changes to the program description of GALL-SLR Report AMP X.M2, the staff amended the fourth paragraph of the program description such that it now states:

> "Guidance on acceptable methods and assumptions for determining reactor vessel neutron fluence is described in the U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." The methods developed and approved using the guidance contained in RG 1.190 are specifically intended for determining neutron fluence in the region of the RPV close to the active fuel region of the core and are not intended to apply to vessel regions significantly above and below the active fuel region

> of the core, nor to RVI components. Therefore, the use of RG 1.190-adherent methods to estimate neutron fluence for the RPV regions significantly above and below the active fuel region of the core and RVI components may require additional justification, even if those methods were approved by the NRC for RPV neutron fluence calculations. This program monitors in-vessel or ex-vessel dosimetry capsules and evaluates the dosimetry data, as needed. Such dosimetry capsules may be needed when the reactor surveillance program has exhausted the available capsules for in-vessel exposure."

Comment: 019

X.M2 Program Description - Page X.M2-1

Add close paraphrases to end of last sentence in second paragraph.

Basis:

Editorial

Markup

…. The neutron irradiation embrittlement TLAAs that are managed by this AMP

…. have been relocated into a pressure-temperature limits report (PTLR)**)**.

RESPONSE:

The staff accepted this comment. In this comment, the commenter identified an administrative typographical error in the program description of AMP X.M2, "Neutron Fluence Monitoring," which the staff fixed by deleting the referenced parenthetical abbreviation that was previously included in the sentence. The reference sentence now reads:

"*The neutron irradiation embrittlement TLAAs that are managed by this AMP. . . . P-T limit curves that have been relocated into a pressure-temperature limits report*."

Comment: 020

X.M2 Program Description - Page X.M2-1, Lines 10-12

Lines 10-12 states, "Accurate neutron fluence values are also necessary to identify the location of the RPV beltline region for which neutron fluence is projected to exceed 1×10^{17} n/cm² (E>1 MeV) during the subsequent period of extended operation." A similar "generic" fluence threshold acceptable to NRC is needed to determine the areas where RVI components are susceptible to Irradiation Assisted Stress Corrosion Cracking (IASCC) so that appropriate inspections are performed and inspection frequencies determined. As described in BWRVIP-26-A, "The threshold fluence level for IASCC has been estimated to be ~5×10^{20} n/cm² (E>1 MeV). Therefore this value should be identified as the accepted neutron fluence threshold for IASCC. Since this is an NRC approved document, is this the accepted neutron fluence threshold for IASCC?

Basis:

Without an NRC accepted threshold for IASCC within the context of the neutron fluence monitoring, a significant cost for possible unnecessary and frequent inspections of components could be realized during the 60 – 80 year period. In particular, regions above and below existing Top Guide, Core Shroud, Jet Pump and RPV Attachment weld locations, which typically within the active core region, but may extend similar to the “extended” beltline region.

Markup

…Accurate neutron fluence values are also necessary to identify the location of the RPV beltline region for which neutron fluence is projected to exceed 1×10^{17} n/cm² (E > 1 MeV) during the subsequent period of extended operation. *Additionally, accurate neutron fluence values are necessary to identify the location of RVI components susceptible to Irradiation Assisted Stress Corrosion Cracking (IASCC) for which neutron fluence is projected to exceed 5×10^{20} n/cm² (E>1 MeV) during the subsequent period of extended operation.*

RESPONSE:

The staff did not accept this comment. The staff did not amend the program description to include the commenter’s proposed sentence to the end of the first paragraph of the program description in AMP X.M2.

The staff acknowledges that it has accepted fluence-based thresholds for initiating IASCC or other radiation-induced aging mechanisms in stainless steel or nickel alloy RVI components on an application-specific basis. However, there may be some variance in the stated thresholds for these aging mechanisms in different industry reports or literature on aging. For example, the threshold stated for initiating IASCC of stainless steel materials in EPRI BWRVIP Technical Report No. BWRVIP-26-A, as cited by the commenter, may be slightly different from the value reported for these materials in the EPRI MRP background reports used for development of EPRI Technical Report No. MRP-227-A. Thus, the staff would expect an applicant to base its considerations on the bounding fluence assumptions used a specific report and the respective applicability of the report to the design basis of the plant being evaluated.

In addition, thresholds set by the industry to date have typically been based on an assessment of accumulated fluence levels over a cumulative 60-year operating life, and have not been updated for 80 years of cumulative operation. As such, it would not be appropriate for the staff to cite specific fluence threshold values in GALL-SLR AMP X.M2 due to the fact that the industry could potentially change their cited threshold values, particularly if the industry were to perform updated 80-year studies of RVI components in order to support future submittals of subsequent license renewal applications.

Thus, applicants for SLR may need to provide some sort of demonstration or justification that the neutron fluence levels for their RVI components at the end of the subsequent period of extended operation will be bounded by those assumed for the components in the industry TRs that are relied on for aging management of the components.

Source 016

Comment: 021

X.M2 Program Description and Elements 1, 3, 4, and 7 - Pages X.M2-1 thru 4

Remove reference to reactor vessel internal components due to the following:

1. current regulations do not involve fluence monitoring of the reactor internals components,

2. the design of the reactor vessel surveillance capsules and placement of these capsules has been optimized to monitor fluence of the reactor vessel not the reactor internals,

3. existing models and fluence calculations for the reactor vessel include some of the reactor internals to account for attenuation of the neutrons through stainless steel but fluence results for the internals have not generally been generated and documented/reported in the reactor vessel surveillance capsule reports, and

4. the concern regarding fluence of the reactor internals must be addressed through calculations and expert elicitation since there are no surveillance capsules for reactor internals fluence monitoring. Basis:

In addition to items stated above, industry bounding fluence projections for individual reactor vessel internal components were/will be determined by BWRVIP and MRP activities to establish recommended inspection requirements and frequencies for reactor vessel internal components for the second period of extended operation.

Markup

See attached sheets. {Markup is on Page 18 of the Reference}

RESPONSE:

The staff did not accept this comment. The staff did not incorporate the commenter's proposal to delete monitoring criteria for reactor vessel internal (RVI) components from the scope of GALL-SLR AMP X.M2, "Neutron Fluence Monitoring."

The NRC staff agrees that current regulations in 10 CFR 50, Appendix H, do not involve fluence monitoring of BWR or PWR RVI components. The NRC staff also agrees that, accordingly, the design of the reactor vessel surveillance capsules and placement of these capsules has been optimized to monitor fluence of the reactor vessel, and not RVI components. However, the staff also acknowledges that industry organizations (e.g., EPRI MRP, EPRI BWRVIP, Westinghouse Electric Company, AREVA, etc.) may have applied what they consider to be bounding thresholds for neutron fluence-related aging effects when developing their augmented inspection or evaluation guideline criteria for RVI components in specific technical reports (TRs) issued by the organizations. The establishment of these thresholds does not necessarily guarantee that the fluence levels for the RVI components at an applicant's facility will be bounded by the neutron fluence values assumed and set for these components in the applicable TRs. Thus, the NRC staff has reviewed the neutron fluence methodologies and projection bases for RVI components in past LRAs as part of the applicant's plant-specific AMP bases for these components. In these instances, transport calculations were used and justified for RVI components on an application-specific or plant-specific basis, and the NRC staff evaluated RVI fluence evaluations on a case-by-case basis, considering the following items:

- Degree of adherence to RG 1.190, as appropriate
- Use of more exact modeling approaches than recommended in RG 1.190, as necessary
- Estimation of calculational uncertainty associated with a specific RVI location
- Margins available for application of an RVI fluence estimate, based on items like the specific stress loading of an RVI

  Therefore, the NRC staff expects that any review of neutron fluence methodologies and projection bases for BWR or PWR RVI components will need to be performed on a case-by-case basis for incoming SLRAs and the staff will use considerations similar to those listed above when performing these types of reviews.

Comment: 022

X.M2 Program Description - Page X.M2-1

Within X.M2 and several SRP further evaluation sections, there is vague discussion regarding additional requirements or further evaluation needed but no supporting rationale or any guidance as to what constitutes an acceptable approach is provided. Lines 40-46 state that fluence methods that have been used and approved under the guidance contained in Reg. Guide 1.190 to calculate fluence near the active core region may not apply to vessel regions above and below the core height, nor to RVI components and may require additional justification. Criteria for what constitutes an acceptable justification are not specified. How is that to be achieved?

Basis:

Concern that changes go beyond compliance with Appendix H considerations without offering a technical basis or justification.

RESPONSE:

The staff did not agree with this comment. The staff did not incorporate any changes to GALL-SLR Report AMP X.M2, “Neutron Fluence Monitoring,” based on receipt of the comment.

The staff acknowledges that the requirements in 10 CFR 50, Appendix H, for RPV materials surveillance programs and withdrawal schedules pertain specifically to base metal and weld components in the RPV that are made from ferritic steel materials and do not apply to reactor vessel internal (RVI) components. However, to the extent that fluence levels affect the treatment of RVI components, fluence assessments and projections are sometimes needed for RVI components in order to satisfy 10 CFR 54 aging management requirements. Specifically, the regulation in 10 CFR 54.21(a)(3) requires license renewal applicants to manage the effects of aging for any structure or component that is scoped in for license renewal in accordance with 10 CFR 54.4 and screened in for an aging management review under the screening requirements in 10 CFR 54.21(a)(1). The staff continues to provide its recommended condition monitoring programs (types of AMPs) for RVI components in GALL-SLR Report AMP XI.M9, “BWR Vessel Internals,” for BWR designed facilities and GALL-SLR Report AMP XI.M16A, “PWR Vessel Internals,” which was reincorporated back into the GALL-SLR Report based on the staff’s efforts to resolve industry comments on pressurized water reactor (PWR) RVI aging management bases.

These AMPs have a common aspect in that they both rely on the implementation of EPRI reports as their aging management bases, and many of these reports have based their assessments of aging on bounding neutron fluence and stress assumptions for the RVI components evaluated in the reports. Thus, it is important for applicants relying on these types of reports for aging management of their RVI components to implement some type of review or evaluation activities for verification that the assumptions in the applicable EPRI reports (including those for irradiation effects) will remain bounding for the assessment of aging in the RVI components through the end of the subsequent period of extended operation for their facilities.

The staff is not imposing any requirement for an applicant to use AMP X.M2 in its SLRA; however, the staff included the AMP in the GALL-SLR Report because the staff felt that a new AMP should be developed for neutron fluence monitoring in the same manner that AMP X.M1, “Fatigue Monitoring,” may be used to accepted metal or structural fatigue TLAAs under 10 CFR 54.21(c)(1)(iii) and to manage cumulative fatigue damage or cracking induced by fatigue or cyclical loads. The staff’s wording in the program description of AMP X.M2 is a reminder that the assumptions used to benchmark a given RPV fluence methodology in accordance with RG 1.190 for RPV component locations in the beltline region of the vessel may not strictly be true if the same fluence methodology was applied to the assessment of RVI components or to RPV component locations outside of the beltline region of the RPV.

The staff has not established any upper-bound acceptance criteria limits on neutron exposures to the RPV or RVI components because fluence exposures to these components would continue to increase as long as the plant was operated under the existing license, including an operating license that has been renewed in accordance with the requirements in 10 CFR Part 54. However, RPV neutron embrittlement TLAAs may set limits on the fluence-dependent TLAA parameters that are calculated in the TLAAs [e.g., RT_{PTS} values in pressurized thermal shock (PTS) assessments for PWRs or upper-shelf energy (USE) values for boiling water reactors (BWRs) and PWRs]. In addition, the evaluation bases for RVI components in industry technical reports that are relied on for aging management of the components may be based on bounding neutron fluence estimates in order to establish a whether a given RVI component is susceptible to irradiation enhanced effects [irradiation-assisted stress corrosion cracking (IASCC), irradiation-effect stress corrosion cracking (IESCC), void swelling or irradiation-enhanced creep]).

Thus, if used in a SLRA, GALL-SLR AMP X.M2 includes activities that would permit an applicant to confirm the adequacy of current fluence methodology used in the CLB and to:

(1) monitor plant operating conditions that may impact assumptions used in the fluence methodology and calculations and (2) assess the need for updates of the qualification database associated with the fluence method as new calculational and measurement data become available for benchmarking. If used for RVI components in SLRA, this program is meant to be used in conjunction with the condition monitoring programs in AMP XI.M16A, “PWR Vessel Internals,” for SLRAs of PWR-designed light-water reactors or AMP XI.M9, “Boiling Water Reactor Vessel Internals,” for SLRAs of BWR-designed light-water reactors. As stated in SRP-SLR Section 3.1.2.2.3, Subsection 2, when this AMP is used as a basis for accepting a given RPV neutron embrittlement TLAA in accordance with TLAA acceptance criterion in 10 CFR 54.21(c)(1)(iii), implementation of AMP X.M2 is to be used in conjunction with an applicant’s implementation of its AMP that corresponds to XI.M31, Reactor Vessel Material Surveillance.”

Comment: 023

X.M2 Program Description–Page X.M2-2 lines 2 and 3 and Element 5 Pages X.M2-3 lines 30-33

A statement is recommended regarding periodic monitoring. By design, the surveillance capsule dosimetry is withdrawn infrequently. Periodic measurements will help to confirm continued accuracy of the neutron fluence calculations. ASTM E2956-14 “Standard Guide for Monitoring the Neutron Exposure of LWR Reactor Pressure Vessels” should be referenced.

RESPONSE:

The staff did not agree with this comment. The staff did not incorporate any changes to AMP X.M2, “Neutron Fluence Monitoring,” based on receipt of the comment.

The commenters stated that AMP X.M2 should be amended to reference that the guidelines and criteria in ASTM Standard Practice E2956-14 as an acceptable basis for implementing neutron fluence monitoring activities. The staff agreed that, for the initial 40-year licensing period, surveillance capsules for reactor vessel components are withdrawn at specific times to comply with the withdrawal schedule requirements for these capsules in 10 CFR Part 50, Appendix H, and ASTM Standard Practice E185-82, which is referenced for use in the Rule. Any additional capsules that are removed and tested to support plant operations during initial periods of extended operation or subsequent periods of extended operation are outside the scope of the capsule withdrawal schedule requirements in ASTM E185-82 because the scope of the ASTM standard is limited only to an initial 40-year licensed operating period. Instead, any additional capsules that may be removed and tested to support plant operations during initial periods of extended operation or subsequent periods of extended operation are performed to satisfy aging management requirements in 10 CFR Part 54, as given in 10 CFR 54.21(a)(3).

ASTM Standard Practice E185-82 references use of ASTM Standard Practice E482 for performing dosimetry tests of dosimeter specimens that are located in reactor vessel surveillance capsules. Although ASTM Standard Practice E2956-14 may constitute a perfectly acceptable technical basis for performing dosimetry testing or monitoring of neutron fluence exposures, its use is not referenced in ASTM Standard Practice E185-82 or in the 10 CFR Part 50, Appendix H rule. Therefore, any proposal to use ASTM Standard Practice E2956-14 for fluence monitoring would need to be proposed, included, and justified in the incoming application (i.e., SLRA) and reviewed by the staff on case-by-case basis, as use of the standard has yet to be endorsed by the staff.

Comment: 024

X.M2 Element 5–Page X.M2-3

Lines 15-18 states “The use of RG 1.190-adherent methods to estimate neutron fluence for the RPV beltline regions significantly above and below the active field region of the core, and RVI components may require additional justification, even if those methods were approved by the NRC for RPV neutron fluence calculations.”

Comment: Why is this needed? What safety problem is to be solved? If an owner has an approved calculation and safety/license/regulatory issues are resolved, why would additional justification be needed and would an owner be obligated to resubmit?

Source 016

Basis:

Concern that changes go beyond compliance with Appendix H considerations without offering a technical basis or justification.

RESPONSE:

The staff did not agree with this comment. The staff did not incorporate any changes to GALL-SLR Report AMP X.M2, “Neutron Fluence Monitoring,” based on receipt of the comment.

The staff acknowledges that the requirements for implementing reactor vessel material surveillance programs in 10 CFR 50, Appendix H, pertain to ferritic components in the reactor pressure vessel (RPV) and not reactor vessel internal (RVI) components. In contrast, the staff’s AMP basis for managing aging in BWR and PWR RVI components are given in two GALL-SLR Report AMPs: (a) AMP XI.M9, “BWR Vessel Internals,” for RVI components in BWRs, and (b) AMP XI.M16A, “PWR Vessel Internals,” for RVI components in PWRs. These AMPs reference augmented inspection criteria for RVI components that are issued in various reports issued by the Nuclear Energy Institute, the Electric Power Research Institute, industry vendors, or PWR or BWR Owners Groups, and assessments of aging in these reports may have been predicted on use of bounding fluence estimates or assumptions for aging effects that are induced by irradiation exposure mechanisms, such as irradiation-assisted stress corrosion cracking (IASCC), loss of preload due to irradiation-assisted creep or stress relaxation, loss of fracture toughness due to neutron irradiation embrittlement, or changes in component dimension induced by irradiation-enhanced grain growth or void swelling.

The staff agrees that the monitoring criteria in AMP X.M2 for RVI components do not have any relationship to the requirements of 10 CFR Part 50, Appendix H, because the rule does not apply to RVI components. For the RVI components, the NRC believes that the effects of aging related to neutron fluence can be successfully managed using either AMP XI.M9 for BWRs or AMP XI.M16A for PWRs. However, to the extent that fluence levels affect the aging management treatment of RVI components, fluence values are sometimes needed to satisfy aging management requirements in 10 CFR Part 54, such as those in 10 CFR 54.21(a)(3), or in 10 CFR 54.21(c)(1)(iii) for dispositioning TLAAs that are accepted based on use of applicable aging management activities or programs. When AMP X.M2 is applied to RVI components, the program is designed to provide neutron fluence results that may then be compared to the neutron fluence thresholds established in the applicable industry reports for RVI components. Thus, the scope of AMP X.M2 was written to include monitoring criteria for RVI components, such that the AMP could be used in conjunction with the programs defined in AMP XI.M9 for BWR RVI components or in AMP XI.M16A for PWR RVI components. Collectively, the criteria provide one method that may be used to monitor neutron fluence exposures for RVI components and to verify that the neutron fluence exposures of the components will be within the bounds of any neutron fluence estimates used in the applicable industry aging management reports for RVI components, as referenced in AMP XI.M9 or AMP XI.M16A (e.g., various ERPI BWRVIP inspection and evaluation guidelines for specific types of BWR RVI components or MRP-227-A for management of PWR RVI components).

GALL-SLR Report AMP X.M2 was also written to provide adequate neutron fluence monitoring criteria for reactor vessel components, especially those reactor vessel components that are within the scope of the neutron irradiation embrittlement TLAAs defined in SRP-SLR Chapter 4.2. Per the updated guidelines in SRP-SLR Section 3.1.2.2.3.2, if AMP X.M2 is used for acceptance of a given RPV neutron embrittlement TLAA in accordance with 10 CFR 54.21(c)(1)(iii), its use is to be used in conjunction with implementation of the AMP and programmatic element criteria in AMP XI.M31, “Reactor Vessel Surveillance.”

<u>Comment</u>: <u>025</u>

X.M2 Element 6–Page X.M2-3

Lines 38-44–Item 6 “Acceptance Criteria” states that RG1.190-adherent methods (for other locations) may require additional justification regarding the level of detail used to represent the core neutron source, the methods to synthesize the 3-D flux field, and the order of the quadrature used in the neutron transport calculations. The applicability of existing qualification data may also require additional justification.

Comment: Acceptable criteria are not specified. How is that to be achieved?

Basis:

Concern that changes go beyond compliance with Appendix H considerations without offering a technical basis or justification.

RESPONSE:

The staff did not agree with this comment. The staff’s basis for resolving this comment is also discussed above in the response to Comment 016-024 to provide the staff’s basis for concluding that neutron fluence monitoring methods for PWR and BWR RVI components need to remain in the scope of GALL-SLR Report AMP X.M2, “Neutron Fluence Monitoring.” The program in AMP X.M2 provides one method that may be used to ensure the validity of any fluence estimates or assumptions that may have applied to the assessment of RVI components in the current licensing basis or design basis of the facility. Thus, the program includes appropriate activities that may be applied to the assessment of RVI components, including activities for: (a) monitoring plant operating conditions relative to the assumptions used in the plant-specific or generic fluence calculations or estimates, and (b) periodically assessing the need for updates of the qualification database associated with the fluence methodology, as new calculational and measurement data become available for benchmarking.

Since the applicability of the qualification recommendations contained in RG 1.190 are most relevant to the beltline region of the RPV, they may not be strictly applicable to those fluence estimates that may be needed for RVI component assessments or assessments for reactor vessel components located outside of the beltline region of the vessel. Thus, plant-specific evaluations of fluence estimates for these types of components locations may need to be included in subsequent license renewal applications and assessed by the staff on a case-by-case basis.

<u>Comment</u>: <u>026</u>

X.M2 Element 10 - Page X.M2-4

Lines 35-36–Item 10 Operating Experience states “The program reviews industry and plant operating experience relevant to neutron fluence.”

Comment: What specific industry operating experience is meant to be reviewed? Fluence evaluations for licensees are often proprietary and not available for other licensees to review.

Source 016

Basis:

Concern that changes go beyond compliance with Appendix H considerations without offering a technical basis or justification.

RESPONSE:

The staff did not agree with this comment.

The staff did not agree with the comment statement that the Operating Experience discussion in GALL-SLR Report AMP X.M2, "Neutron Fluence Monitoring," goes beyond compliance with Appendix H considerations without offering a technical basis or justification. Specifically, the staff's GALL-SLR Report, SRP-SLR, and the industry's guidance document for developing SLRAs (i.e., NEI Report No. NEI 17-01) call for subsequent license renewal applicants to include OE reviews as part of the program element criteria for their AMPs. The inclusion of this type of sentence in the Operating Experience program element of AMP X.M2 is consistent with the lead-in sentences in the Operating Experience program elements of other GALL-SLR Report AMPs and is based on conformance with SRP-SLR Section A.1.2.3.10, and in NEI guidance for performing relevant operating experience reviews in NEI Report No. 17-01. Inclusion of this sentence in the Operating Experience program element has no relevancy to a given licensee's implemented actions for demonstrating compliance with requirements in 10 CFR Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements."

If GALL-SLR Report AMP X.M2 is adopted for inclusion in an SLRA, it is up to the applicant to decide which type of OE data provides relevant OE information for program element 10, Operating Experience, in the AMP. That being said, relevant OE for this AMP could involve OE with the occurrence of component specific aging effect occurrences, where the aging effect was induced or enhanced by neutron fluence exposure mechanisms (e.g., recent OE with IASCC in baffle-former bolts) or fluence monitoring OE that summarizes component fluence exposures greater than those assumed and used in the CLB for the components.

The staff acknowledges that OE summaries may include subject matter that is designated as constituting trade secret or proprietary information from industry licensees or organizations. This is true of any information that may be docketed with the NRC. However, this is not an adequate basis for omitting such information from the scope of the information that is contained in a LRA or SLRA. As always, the staff's treatment of any information in an SLRA that is marked as proprietary information or trade secrets will be appropriately processed for a withholding determination by the staff in accordance with the process for reviewing such information in 10 CFR 2.390, and will be withheld from dissemination to the members of the general public if the staff determines that the information meets the basis for withholding stated in the 10 CFR 2.390 rule. Such information will need to be processed with an appropriate proprietary affidavit from the organization that is designating the information as being proprietary or as trade secrets.

Comment: 027

XI.M1 Program Description Page XI.M1-1

Delete the wording "in the 2007 edition, with 2008 addenda" and replace with "in accordance with the applicable plant ASME Code Section XI edition(s) and approved addenda."

Basis:

The specific ASME Code editions and addenda will differ between the different units, and change as the code requirements are revised. Having the specific Code year and addenda may lead to unnecessary exceptions on the various SLR applications. Also, this revised wording will more closely align with the Description of Program in Table 3.0-1.

<u>Markup</u>

… effects. Inspection of these components is covered in Subsections IWB, IWC, and IWD, respectively, in ~~*the 2007 edition, with 2008*~~ <u>*accordance with the applicable plant ASME Code Section XI edition(s) and approved addenda*</u>. The program generally includes periodic visual, surface, and/or volumetric examination and leakage test of Class 1, 2, and 3 pressure-retaining components and their integral attachments.

RESPONSE:

The staff partially agreed because, as the original NEI suggestion was disagreed with by the staff, the staff did propose alternate language below. The panel recommended the following change (underlined) to be added: as "Inspection of these components is covered in Subsections IWB, IWC and IWD, respectively, in <u>accordance with the applicable plant ASME Code Section XI editions and addenda as required by 10 CFR 50.55a(g)(4)</u>.

The staff believes the alternate language is more accurate because it does not depend on a specific version of the ASME code as proposed by NEI. In addition, it highlights the importance of the ISI standard requirement for operating plants required by 10 CFR 50.55(a)(g)(4).

<u>**Comment**: **028**</u>

XI.M1 Elements 3, 4, 5, 6 Pages XI.M1-1 through XI.M1-3

The separator "and" for these code references should be changed to "or" since only one Code paragraph applies to a particular ASME component. This editorial occurrence is common in several locations throughout the document.

Basis:

Only one Code paragraph applies to a particular ASME component.

<u>Markup</u>

Parameters Monitored or Inspected

The ASME Section XI ISI program detects degradation of components by using the examination and inspection requirements specified in ASME Section XI Tables IWB-2500-1, IWC-2500-1, ~~*and*~~ <u>*or*</u> IWD-2500-1 for Class 1, 2, and 3 components, respectively.

Detection of Aging Effects

Components are examined and tested as specified in Tables IWB-2500-1, IWC-2500-1, ~~*and*~~ <u>or</u> IWD-2500-1 for Class 1, 2, and 3 components, respectively. The tables specify the extent and schedule of the inspection and examination methods for the components of the pressure-retaining boundaries.

Monitoring and Trending

For Class 1, 2, and 3 components, the inspection schedule of IWB-2400, IWC-2400, ~~*and*~~ or IWD-2400, and the extent and frequency of IWB-2500-1, IWC-2500-1, ~~*and*~~ or IWD-2500-1, respectively, provides for timely detection of degradation. The sequence of component examinations established during the first inspection interval is repeated during each successive inspection interval, to the extent practical. Volumetric and surface examination results are compared with recorded preservice examination and prior inservice examinations. Flaw conditions or relevant conditions of degradation are evaluated in accordance with IWB-3100, IWC-3100, ~~*and*~~ or IWD-3100.

Examinations that reveal indications that exceed the acceptance standards described below are extended to include additional examinations in accordance with IWB-2430, IWC-2430, ~~*and*~~ or IWD-2430 for Class 1, 2, and 3 components, respectively. Examination results that exceed the acceptance standards below are repaired/replaced or accepted by analytical evaluation in accordance with IWB-3600, IWC-3600 ~~*and*~~ or IWD-3600, as applicable. Those items accepted by analytical evaluation are re-examined during the next three inspection periods of IWB-2410 for Class 1 components, IWC-2410 for Class 2 components, and IWD-2410 for Class 3 components.

Acceptance Criteria

Any indication or relevant conditions of degradation are evaluated in accordance with IWB-3000, IWC-3000, ~~*and*~~ or IWD-3000 for Class 1, 2, and 3 components, respectively. Examination results are evaluated in accordance with IWB-3100, IWC-3100, ~~*and*~~ or IWD-3100 by comparing the results with the acceptance standards of IWB-3400 and IWB-3500 for Class 1, IWC-3400 and IWC-3500 for Class 2, and IWD-3400 and IWD-3500 for Class 3 components. Flaws that exceed the size of allowable flaws, as defined in IWB-3500, IWC-3500 ~~*and*~~ or IWD-3500 may be evaluated by using the analytical procedures of IWB-3600, IWC-3600 ~~*and*~~ or IWD-3600 for Class 1, 2 and 3 components, respectively.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made.

The staff decided that:

(1) In Parameters Monitored “and” is correct (as is);

(2) In Detection of Aging Effects “and” is correct (as is);

(3) In Monitoring and Trending, last sentence of 1st paragraph, change it from “and” to “or” and in the last sentence of 2nd paragraph, also change it from “and” to “or”; and

(4) In Acceptance Criteria: to change the “and” to “or” in the 2nd place while keeping the other three “ands” (as is).

These changes (from “and” to “or”) make the text correct because all three sections (IWB-3100, IWC-3100 and IWD-3100) contain evaluation and acceptance criteria for the flaw condition. The criteria in any one of the three sections are acceptable.

Comment: 029

XI.M2 Program Description

The “Program Description” section references: BWRVIP-190 Revision 0 (1016579) for BWRs; and “PWR Primary Water Chemistry Guidelines” Revision 6 and “PWR Secondary Water Chemistry Guidelines” Revision 7 for PWRs. These water chemistry guidelines are periodically updated by EPRI. For example, most BWRs have updated their water chemistry programs to BWRVIP-190 Revision 1 and most PWRs have updated to PWR Primary Water Chemistry Guidelines” Revision 7.

Basis:

Continued referencing of earlier versions of these guidelines will result in unnecessary exceptions. Updates and revision of these guidelines are based on operating experience and thorough research, and are reviewed and approved by the industry. Therefore, it is recommended that the “Program Description” section reference the most recent revision of the guidelines or reference the revision in place at the time the as a SLR-GALL is approved.

Markup

The water chemistry program for boiling water reactors (BWRs) relies on monitoring and control of reactor water chemistry based on industry guidelines contained in the current approved revision of Boiling Water Reactor Vessel and Internals Project (BWRVIP)-190~~ *([Electric Power Research Institute [(EPRI]) 1016579).].*~~ The BWRVIP-190 has three sets of guidelines: (i) one for reactor water, (ii) one for condensate and feedwater, and (iii) one for control rod drive (CRD) mechanism cooling water. The water chemistry program for pressurized water reactors (PWRs) relies on monitoring and control of reactor water chemistry based on industry guidelines contained in current approved revisions of EPRI ~~*1014986*~~ 3002000505 (“PWR Primary Water Chemistry Guidelines-,” Revision ~~*6*~~*7*) and EPRI 1016555 (, “PWR Secondary Water Chemistry Guidelines-,” Revision 7).

RESPONSE:

The staff did not agree with this comment. The NRC cannot reference documents that do not have a date or revision number. Without a reference to a date or revision number, the staff cannot ensure that future revisions will provide an adequate aging management guidance in this AMP.

Comment: 030

XI.M2 Program Description

Add control of dose rates as an additional benefit of using additives in PWRs.

Source 016

Basis:

Control of dose rates is an important benefit of additives that should be included in the AMP.

<u>Markup</u>

The program includes specifications for chemical species, impurities and additives, sampling and analysis frequencies, and corrective actions for control of reactor water chemistry. System water chemistry is controlled to minimize contaminant concentration and mitigate loss of material due to general, crevice, and pitting corrosion and cracking caused by SCC. For BWRs, maintaining high water purity reduces susceptibility to SCC, and chemical additive programs such as hydrogen water chemistry or noble metal chemical application also may be used. For PWRs, additives are used for reactivity control, ~~*and*~~ to control pH <u>*and dose rates*</u>, and inhibit corrosion.

RESPONSE:

The staff agreed with this comment. The staff revised the last sentence of the Preventive Actions program element to state, “For PWRs, additives are used for reactivity control, and to control pH and dose rates, and inhibit corrosion.”

<u>**Comment**: **031**</u>

XI.M3 Preventive Actions

Remove the 150ksi preventive measure recommendation by deleting 2.(d).

Basis:

The program Element 2 description includes a preventive measure (to reduce the potential for SSC) in which the bolting material for reactor head closure studs have an actual measured yield strength less than 150 ksi. This limitation (yield strength less than 150 ksi) is based on a position described in Regulatory Guide 1.65, Revision 1 (issued in 2010).

The reactor head studs for many nuclear power plants were fabricated consistent with Regulatory Guide 1.65, Revision 0 (issued in 1973). This earlier version of Regulatory Guide 1.65 did not take the position that reactor head studs should be fabricated from materials with actual measured yield strength less than 150 ksi; but rather, took the position that the maximum ultimate tensile strength of stud bolting material should not exceed 170 ksi. As such, many nuclear plants have reactor head closure studs in which the actual measure yield strength slightly exceeds 150 ksi but with an actual ultimate tensile strength less than 170 ksi. Previous 40 to 60 year License Renewal Applications for plants in this situation have declared exceptions to this recommendation and provided through justifications for the exceptions. These justifications included the basis that these studs are UT examined for cracks in accordance with ASME Section XI.

Since many nuclear plants did not have to opportunity prior to 2010, to order reactor head studs with yield strength less than 150 ksi, this recommendation is not a reasonable preventive measure for reactor head studs fabricated prior to 2010. The opportunity to take advantage of this one-time preventive measure is not valid for these studs, but could be used for purchasing reactor head studs going forward.

The 150 ksi limitation is intended to reduce the potential for cracking due to SCC. The existing program performs UT examinations for cracking of these studs per ASME Code, Section XI, Table IWB-2500-1. As such cracking due to SSC will be identified and corrected regardless of material in which the studs were fabricated. Recent operating experience related to cracking of reactor head closure studs has shown no instances of cracking in these components.

Continuing to recommend this limitation (less than 150 ksi) for studs fabricated prior to 2010 is unnecessary and will results in unnecessary declarations of exceptions in future SLR applications.

<u>Markup</u>

Preventive Actions: Preventive measures may include:

(a) Avoiding the use of metal-plated stud bolting to prevent degradation due to corrosion or hydrogen embrittlement;

(b) (Using manganese phosphate or other acceptable surface treatments;

(c) Using stable lubricants. Of particular note, use of molybdenum disulfide (MoS_2) as a lubricant has been shown to be a potential contributor to SCC and should not be used

(d) (Using bolting material for closure studs that has an actual measured yield strength less than 1,034 megapascals (MPa) (150 kilo-pounds per square inch). Or revise by adding the 170ksi for existing studs and 150ksi for newly-purchased studs going forward.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. Staff retained element 2(d) but added additional text to include 170 ksi ultimate tensile strength for existing studs.

Staff agreed to 170 ksi ultimate tensile strength (UTS) for existing bolting in order to reduce unnecessary exceptions to the GALL-SLR Report AMP XI.M3, “Reactor Head Closure Stud Bolting.” Staff has previously accepted the exception to the 150-yield strength for closure bolting based on the expected non-destructive examination of the studs, and the available industry operating experience (i.e., confirmed SCC of closure studs has not occurred for closure studs with a measured maximum UTS less than 170 ksi).

<u>**Comment**: **032**</u>

XI.M4 Element 4 - Page XI.M4-1

The vessel ID attachment welds are visually examined in accordance with the requirements of ASME Code, Section XI, Table IWB-2200-1, Examination Category B-N-2. Revise Element 4 as follows: ~~*“In addition, certain attachment welds are subject to augmented examinations.*~~ <u>*The inspection and evaluation guidelines of BWRVIP-48-A recommend more stringent inspections for certain attachment welds.*</u> BWRVIP-48-A specifies the nondestructive examination methods, inspection locations, and inspection frequencies for these augmented examinations.”

Source 016

Basis:

The scope of program clearly states that the welds within the scope of the program are those covered under BWRVIP-48-A and that BWRVIP-48-A provides augmented inspection criteria. The sentence recommended for deletion implies that in addition to the welds covered in Exam Category B-N-2, BWRVIP-48-A covers additional welds with augmented exams. The scope of welds covered by Exam Category B-N-2 is the same as the scope of welds in BWRVIP-48-A. The sentence added is from Gall Rev. 2 and is consistent with Element 1 and clarifies why the inspection methods in BWRVIP-48 can supersede those specified by Exam Category B-N-2.

Markup

Detection of Aging Effects:

The extent and schedule of the inspections prescribed by BWRVIP-48-A and ASME Code, Section XI, are designed to maintain structural integrity and ensure that aging effects are discovered and repaired before a loss of intended function. The vessel ID attachment welds are visually examined in accordance with the requirements of ASME Code, Section XI, Table IWB-2500-1, Examination Category B-N-2. ~~*In addition, certain attachment welds are subject to augmented examinations.*~~ *The inspection and evaluation guidelines of BWRVIP-48-A recommend more stringent inspections for certain attachment welds.* BWRVIP-48-A specifies the nondestructive examination methods, inspection locations, and inspection frequencies for these augmented examinations. The nondestructive examination techniques that are appropriate for the augmented examinations, including the uncertainties inherent in delivering and executing these techniques and applicable for inclusion in flaw evaluations, are included in BWRVIP-03.

RESPONSE:

The staff agreed with this comment. BWRVIP-48A is sufficient for augmented inspection of the welds.

Comment: 033

XI.M5 Element 4 Detection of Aging Effects, and XI.M5 UFSAR Supplement–
Pages XI 01-20, 21

This AMP should be eliminated completely, since the activities have been incorporated in the normal station activities. As an alternative to deleting the program, modify wording as shown in Markup section.

Basis:

(a) For all feedwater thermal sleeve designs, the inspection frequency for Zones 1, 2 and 3 is per GE NE 523 A71-0594-A, Revision 1 [Table 6-1]. The way these paragraphs are written implies that there are different source requirements for the required inspection frequency depending on the thermal sleeve design and that these frequencies may be different than that in Table 6.1. Table 6.1 includes all information that was added to Element 4 and the UFSAR Supplement that is recommended for deletion.

(b) Depending on the UT Method used, the inspection interval can be more frequent than once every 10 years (for plants with triple thermal sleeve design) per GE NE 523 A71-0594-A, Revision 1 as presented in Table 6-1. For instance, if a manual UT method is used (as was done at LGS recently, due to unavailability of the automated UT equipment) the exam frequency had to be every 3 years until the frequency was reset to 10 years after auto UT was performed.

Markup

XI.M5 - SRP Table 3.0-1:

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 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 *in accordance with GE NE 523 A71-0594-A, Revision 1 [Table 6-1].* ~~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] 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.*~~

GALL XI.M5 Element 4 Markup:

Detection of Aging Effects:

Cracking is detected through ultrasonic critical regions of the BWR feedwater nozzle. These critical regions cover the nozzle inner radius and bore as depicted in Zones 1, 2, and 3 on Figures 4-1 and GE-NE-523-A71-0594-A, Revision 1. The ultrasonic examination procedures, equipment, and personnel are qualified by performance demonstration in with ASME Code, Section XI, Appendix VIII.

~~*For plants without single sleeve interference fit feedwater spargers, the frequency for Zones 1, 2, and 3 is once every 10-year ASME Code, Section XI, ISI interval.*~~

~~*For plants with single sleeve interference fit feedwater spargers, t*~~***T***he inspection for Zones 1***,*** ~~*and*~~ 2***,*** *<u>and 3</u>* is in accordance with Table 6-1 of GE-NE-523-A71-Revision 1***,*** *<u>not to exceed once every 10-year ASME Code, Section XI, ISI Interval</u>*.

mechanics analysis and the particular type of ultrasonic examination method that employed. The plant-specific fracture mechanics analysis should use the latest fatigue crack growth rates in a water environment that have been endorsed by the U.S. Nuclear Regulatory Commission (NRC). ~~*For these plants, the inspection for Zone 3 is twice the inspection interval established for Zones 1 and 2, not to once every 10 years.*~~

RESPONSE:

The staff agreed with this comment. The AMP has been eliminated. Improvements in regulatory requirements for volumetric testing qualifications eliminate the need for the methods outlined in GALL-SLR Report AMP XI.M5 and make ASME Code methods under GALL-SLR Report AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” appropriate. The updated ASME Code methods include an approved Code case, which can be tied to the qualification requirements.

<u>**Comment**: **034**</u>

XI.M5 Program Description

NUREG–0619 should be sunset and this AMP eliminated.

Basis:

NRC produced NUREG–0619 and included their implementation positions in GL 81-11. The original problem was BWR Feedwater nozzle inner radius cracking and limited UT capabilities. Crack initiation was eliminated by plant operational changes–no inner radius cracking in 30+ years for any sparger type. Inspection capabilities are much advanced over those in 1981 and the use of Section XI Appendix VIII assures adequate flaw identification.

RESPONSE:

The staff agreed with this comment. Improvements in regulatory requirements for volumetric testing qualifications eliminate the need for the methods outlined in GALL-SLR Report AMP XI.M5, which was deleted and make ASME Code methods under AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” appropriate. The updated ASME Code methods include an approved Code case which can be tied to the qualification requirements.

<u>**Comment**: **035**</u>

XI.M7 Element 1 - Page XI.M7-1

The GALL AMP, as discussed in the Program Description, is based on the applicant commitment to NRC GL 88-01 which defined the scope of components within the commitment to be piping and welds containing reactor coolant at temperature above 90°C (200°F). This should be changed to remain consistent with NRC GL 88-01.

Basis:

The GALL AMP, as discussed in the Program Description, is based on the applicant commitment to NRC GL 88-01 which defined the scope of components within the commitment to be piping and welds containing reactor coolant at temperature above 90°C (200°F). This should be changed to remain consistent with NRC GL 88-01. Note that the UFSAR Supplement section for this AMP still correctly references 93°C and 200°F. The change in temperature is a contradiction to NRC's own technical basis referenced two sentences later–e.g., the scope of GL 88-01 has been shown to be adequate and the inspection programs implemented by the industry have managed SCC of BWR piping extremely well.

Markup

….austenitic–SS and nickel alloy that are 4 inches or larger in nominal diameter containing reactor coolant at a temperature above *93*~~*60*~~°C [*200*~~*140*~~°F] during power operation, regardless of code classification. The program also applies to pump…

RESPONSE:

The staff agreed with this comment. The temperature threshold, which is used to determine components within the program scope, is revised to reflect the original temperature threshold {i.e., 93 °C [200 degrees F]}. This revision is consistent with the staff position in GL 88-01.

Comment: 036

XI.M7 Element 1 - Page XI.M7-1

It is unnecessary to call out specific components within the scope of the AMP. There may be plants where the size of the CRDRL nozzle cap is less than 4 inches, or is not stainless steel, and therefore, the nozzle-to-cap weld would not be within this AMP and an unnecessary GALL exemption would need to be documented.

Basis:

There is adequate discussion of the program scope to be clear without calling out this specific component. If the statement must remain to support deletion of AMP XI.M6, then it should clarify that the nozzle-to-cap weld may be in the scope of the AMP.

Markup:

~~*Control rod drive return line nozzle caps and associated welds are included in the scope of the program.*~~ NUREG–0313, Rev. 2 and NRC GL 88-01,

RESPONSE:

The staff partially agreed with this comment. The sentence is revised to indicate that control rod drive return line nozzle caps and associated welds may be included in the scope of GALL-SLR Report AMP XI.M7, "BWR Stress Corrosion Cracking." This revision is based on the following:

(1) the former GALL Report, Revision 2, AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle," has been deleted from the GALL-SLR Report programs, and (2) GALL-SLR Report AMP XI.M7 includes volumetric inspections that are sufficient to manage cracking for these control rod drive return line components.

Comment: 037

XI.M7 Elements 3 and 4–Page XI.M7-2

Delete the references to BWRVIP-75-A.

Basis:

BWRVIP-75-A does not include guidance relative to examination or inspection methods or test techniques. BWRVIP-75-A only provides optional guidance to that provided in GL 88-01, relative to the number of welds that need to be inspected and the frequency of inspections (extent and schedule, as discussed in GALL). This is stated in the program description and Element 4. Therefore reference to BWRVIP-75-A should be deleted from Element 3 and modified in Element 4.

Markup

Scope of Program:

The program focuses on (a) managing and implementing countermeasures to mitigate IGSCC and (b) performing ISI to monitor IGSCC and its effects on the intended function of BWR piping components within the scope of renewal. The program is applicable to all BWR piping and piping welds made of austenitic–SS and nickel alloy that are 4 inches or larger in nominal diameter reactor coolant at a temperature above 60°C [140°F] during power operation, regardless of code classification. The program also applies to pump casings, valve bodies, and reactor vessel attachments and appurtenances, such as head spray and vent components. ~~*Control rod drive return line nozzle caps and associated welds are included in the scope of the program.*~~ NUREG–0313, Rev. 2 and NRC GL 88-01, respectively, describe the technical basis and staff guidance regarding mitigation of IGSCC in BWRs. Attachment A of NRC GL 88-01 delineates the staff-approved positions regarding materials, processes, water chemistry, weld overlay partial replacement, stress improvement of cracked welds, clamping devices, crack characterization and repair criteria, inspection methods and personnel, inspection

Parameters Monitored or Inspected:

The program detects and sizes cracks and detects leakage by using the examination and inspection guidelines delineated in NUREG–0313, Rev. 2, and NRC GL 88-01.~~*or the referenced BWRVIP-75-A guideline as approved by the NRC staff.*~~

Detection of Aging Effects:

The extent, method, and schedule of the inspection test techniques delineated in NRC GL 88-01 ~~*or BWRVIP-75-A*~~ are designed to structural integrity and ensure that aging effects are discovered and repaired before the loss of intended function of the component. Modifications to the extent and schedule of inspection in NRC GL 88-01 are allowed in accordance with the inspection guidance in approved BWRVIP-75-A. Prior to crediting hydrogen water chemistry to modify extent and frequency of inspections in accordance with BWRVIP-75-A, the applicant should meet conditions described in the staff's safety evaluations regarding BWRVIP-62-A. Program uses volumetric examinations to detect IGSCC. Inspection can reveal and leakage of coolant. The extent and frequency of inspection recommended by the program are based on the condition of each weld (e.g., whether the weldments were made from IGSCC-resistant material, whether a stress improvement process was applied to a weldment to reduce residual stresses, and how the weld was repaired, if it had been cracked).

RESPONSE:

The staff agreed with this comment. The references to BWRVIP-75-A are deleted as the comment recommended. With respect to the control rod drive return line nozzle caps and associated welds (described in the markup), see the previous response above to Comment 019-036.

Comment: 038

XI.M9 Program Description–Page XI.M9-1

Page XI.M9-1, rows 19 thru 44 (Program Scope) describe screening criteria applicable to CASS reactor internals and page XI.M9-3, row 28 includes a fluence threshold of 1E17 n/cm^2 for consideration of fracture toughness in CASS reactor internals. The content of Section XI.M9 does not reflect this fact. A recommended approach is to defer to an NRC accepted approach (as documented in BWRVIP-234 and the associated NRC SE).

An allowance for an alternative screening criteria is mentioned on page XI.M9. However, the text should be clarified to confirm that one acceptable alternative is the screening criteria associated with BWRVIP-234 and the associated NRC SE. Further, it reasonable to clarify that CASS BWR reactor internals continuing to meet the screening criteria contained in BWRVIP-234 (as accepted with modification by NRC NRR) do not require examination until such time as the screening criteria are no longer met. Specifically, the technical bases for exemption should stand independent of operating time or licensed operating period.

Basis:

There are ongoing activities related to NRC review of the BWRVIP approach for management of CASS internals. A draft SE recently received by the BWRVIP for review indicates that, with slight modification, NRC DE accepts the BWRVIP position in BWRVIP-234. As a result, castings meeting these revised screening criteria do not require inspection.

RESPONSE:

The staff partially agreed with this comment. The staff issued a safety evaluation (SE) in June 2016, regarding BWRVIP-234. The SE includes the staff-approved screening criteria for the susceptibility of cast austenitic stainless steel (CASS) internals to loss of fracture toughness due to neutron and thermal aging embrittlement. Applicants may use the approved screening criteria. If the conditions of certain CASS components exceed the screening criteria, the applicant should evaluate the need for additional aging management activities for those components (such as, additional inspections beyond the existing inspections).

Source 016

Comment: 039

XI.M9 Element 1–Page XI.M9-2

Modify the scope of the program as described in the markup section. Delete the phrase, "BWRVIP-50-A is a repair design" document and is not needed for aging management and should not be referenced. (Applies generically to all repair design criteria documents)

Basis:

BWRVIP-183 establishes an inspection scope of 10% of the grid beam cells to be inspected every 12 years with at least 5% of the inspections performed in the first 6 years of each 12-year interval. All BWRs that entered the 60-year PEO are already implementing this inspection schedule and should be continuing that schedule through the SLR PEO. Requiring the 12-year inspection interval to reset and re-start at the beginning of the subsequent PEO, and requiring that 5% of the inspections be performed in the second 6-year period of the 12-year interval starting at the beginning of the SLR PEO will disrupt the scheduling of inspections per BWRVIP-183 and could likely delay inspections that would be scheduled to maintain the current BWRVIP-183 inspection schedule. Most plants perform all 10% of the inspections within the first 6 years of each 12-year interval, primarily for efficiency purposes. I don't expect that the NRC intended to require the applicant to possibly delay inspections to be GALL compliant. The revised wording implements a continued inspection schedule in accordance with BWRVIP-183, which is believed to be what was intended.

Markup

Top guide: BWRVIP-26-A and BWRVIP-183 provide guidelines for inspection and evaluation; ~~*BWRVIP-50-A provides guidelines for repair design criteria.*~~ The *requires* inspect~~s~~*ion* of ~~5~~10 percent of the top guide locations using enhanced visual technique, EVT-*1 every 12 years with at least 5 percent within the first 6 years of each 12-year interval.*~~*after entering the subsequent period of extended operation.*~~

~~*An additional 5 percent of the top guide locations will be inspected within 12 years after entering the subsequent period of extended operation.*~~

RESPONSE:

The staff partially agreed with these comments. The staff did not agree with the recommendation to delete BWRVIP repair design criteria guidelines including BWRVIP-50-A because the repair activity is an important attribute of aging management and this AMP. The staff agreed with the comment regarding the applicability of the inspection guidelines in BWRVIP-183.

Comment: 040

XI.M9 Element 1–Page XI.M9-3

Modify the scope of the program as delineated in the markup section.

Basis:

Control rod drive housing and lower plenum components are managed consistent with BWRVIP-47-A as described in GALL Report AMP XI.M8, Boiling Water Reactor Penetrations. Therefore, components managed by BWRVIP-47-A do not need to also be managed by this AMP or discussed within Element 1, Scope of Program for this AMP.

Markup

~~*Control rod drive (CRD) housing and lower plenum components: BWRVIP-47-A provides guidelines for inspection and evaluation; BWRVIP-55-A provides guidelines repair design criteria.*~~

RESPONSE:

The staff did not agree with this comment. BWRVIP-47 includes reactor vessel internal portions of CRD housing and lower plenum components in its scope. For clarity, the staff revised the description as follows: "Control rod drive (CRD) housing and lower plenum components (reactor vessel internal components). BWRVIP-47-A provides guidelines for inspection and evaluation; BWRVIP-55-A provides guidelines for repair design criteria." In addition, the staff kept the reference to BWRVIP-55-A because the BWRVIP report provides guidance for repair design criteria and activities.

Comment: 041

XI.M9 Element 3, Page XI.M9-4, Lines 4-7)

Consider deletion of the reference to the aging effect of stress relaxation for jet pump hold down beams.

Basis:

Jet pump beams are replaceable component, and stress relaxation has not been identified as a degradation mechanism in BWRVIP-138R1-A. It should also be noted that the draft SRP-SLR does not address this aging effect (Reference Paragraph 3.1.2.2.14 of draft NUREG–2192*).*

Markup

This program also manages loss of preload due to thermal or irradiation-enhanced stress relaxation 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.

RESPONSE:

The staff did not agree with this comment. The staff views that the jet pump hold down beam bolts are subject to loss of preload due to thermal or irradiation-enhanced stress relaxation. As discussed in NRC Bulletin 80-07, "BWR Jet Pump Assembly Failure," attention should be paid to evidence of distress that could be indicative of loss of beam assembly preload during visual inspections. This position is consistent with the SLR guidance. The staff also noted that industry aging management activities include evaluation of fluence effects on these bolts in terms of reduction in bolt preload. In addition, the staff added BWRVIP-138, Revision 1-A, "BWR Vessel and Internals Project, Updated Jet Pump Beam Inspection and Flaw Evaluation Guidelines," to the references section of GALL-SLR Report AMP XI.M9, "BWR Vessel Internals."

Comment: 042

XI.M9 Element 4

Modify the detection of aging effects section as described in the markup section.

Basis:

ASME Section XI, Subsection IWB, Table IWB-2500-1, Examination Category B-N-2 covers welded core support structures that are managed within this AMP and interior attachments to reactor vessels that are components managed consistent with BWRVIP-48-A as described in GALL Report AMP XI.M4, Boiling Water Reactor ID Attachment Welds. Therefore, components managed by BWRVIP-48-A are not managed by this AMP.

ASME Section XI, Subsection IWB, Table IWB-2500-1, Examination Category B-N-1 covers Reactor Vessel internal components with Item Number B.13.10, as clarified in Note 1 of the table. The examination method specified for Item Number B13.10 is VT-3, not VT-1, and therefore needs correction. The VT-1 examinations specified for item Number B13.20 is for internal attachment welds within the beltline that are managed by GALL Report AMP XI.M4, Boiling Water Reactor ID Attachment Welds, consistent with BWRVIP-48-A guidelines.

Markup

Detection of Aging Effects:

The extent and schedule of the inspection and test techniques prescribed by the applicable and staff-approved BWRVIP guidelines are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of BWR vessel internals. Vessel internal components are inspected in accordance with the requirements of ASME Section Subsection IWB*, Table IWB-2500-1*, Examination Category B-N-2 *for core support structures, and Examination Category B-N-1 for other reactor internal components.* ~~*ASME Section XI inspection specifies visual VT-1 examination to detect discontinuities and imperfections such as cracks, corrosion, wear, or erosion, on the surfaces of components.*~~ This inspection ~~*also*~~ specifies visual VT-3 examination to determine the general and structural condition of the component supports by (a) verifying parameters, such as clearances, settings, and physical displacements and (b) detecting discontinuities and imperfections, such as loss of integrity at bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion. BWRVIP program requirements provide for inspection of BWR internals to manage loss of material and cracking using appropriate examination techniques such as visual examinations (e.g., EVT-1, VT-1) and volumetric examinations [e.g., ultrasonic testing (UT)].

RESPONSE:

The staff partially agreed with this comment. Applicants may have accessible core support structures subject to Examination Category B-N-1. The staff agreed with the proposed additions and deletions, but did not include "other" from the proposed phrase, "Examination Category B-N-1 for other reactor internal components"

<u>Comment</u>: <u>043</u>

XI.M10 Element 3 - Page XI.M10-2

Consider clarification of this paragraph to identify that the listed parameters monitored in the 2nd paragraph apply to inside containment only.

Basis:

As written, the paragraph could be misinterpreted to monitor these parameters throughout the plant where available resulting in monitoring that provides no value relative to the Boric Acid Program.

<u>Markup</u>

In order to identify potential plant issues not detected during walkdowns and maintenance, *<u>inside containment</u>* the program tracks airborne radioactivity monitors, humidity monitors, temperature monitors, reactor coolant system water inventory balancing, and containment air cooler thermal performance. The program also looks for evidence of boric acid deposits on control rod drive (CRD) mechanism shroud fans, containment air recirculation fan coils, containment fan cooler units, and airborne filters.

RESPONSE:

The staff agreed with the comment, but not the proposed wording in above markup. In order to identify potential borated water leaks inside containment that have not been detected during walkdowns and maintenance, the program tracks airborne radioactivity monitors, humidity monitors, temperature monitors, reactor coolant system water inventory balancing, and containment air cooler thermal performance. The program also looks for evidence of boric acid deposits on control rod drive (CRD) mechanism shroud fans, containment air recirculation fan coils, containment fan cooler units, and airborne filters.

The revised wording clarifies that the listed parameters monitored only apply to leakage inside containment. In addition, the broad term “plant issues” is clarified to limit the scope of monitoring to borated water leaks.

<u>Comment</u>: <u>044</u>

XI.M10 Element 4–Page XI.M10-2

A technical justification for not removing obstructions to visual inspections should be clarified for insulated components.

Basis:

Criteria for removing insulation for inspection is already provided in Element 4. Additional justification should not be required for insulated components unless specific leakage is observed.

<u>Markup</u>

… Conditions leading to boric acid corrosion, such as crystal buildup and evidence of moisture, are readily detectable by visual inspection, though removal of insulation may be required in some cases. *For non-insulated components,* obstructions to visual inspections are removed unless a technical justification is documented by the program owner. *For insulated components, the technical justification is required only if there is evidence of leakage.* Criteria for removing insulation for bare-metal inspections include the safety significance of the location, evidence of leakage from under the insulation, bulging of the insulation, and operating experience. …

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

The comment contradicts guidance in the industry guidance document WCAP-15988, Revision 2, Section 4.2, Obstructions to Visual Inspections, which states "The objective of this element is to ensure that obstructions to visual inspections shall be removed for inspection, unless a technical justification for not performing the visual inspection is prepared." According to the guidance, "the BACCP (boric acid corrosion control program) of each utility must address each of the mandatory objectives described in Sections 4.1 through 4.11 of this WCAP."

Comment: 045

XI.M10 Element 4 - Page XI.M10-2

Shifting the burden of proof on whether insulation or other visual obstruction removal is required to facilitate visual inspection from condition-driven when external indicators suggest the possibility of a leak, to documenting in a technical evaluation why a visual "obstruction" was not removed [4–Detection of Aging Effects] is unwarranted.

Basis:

BAC Programs are well-established, regularly reviewed by INPO, and required to be "learning programs" that monitor and incorporate OE routinely as appropriate. While reflecting that evolution in the GALL may be reasonable, using SLR as a way to establish new program expectations is not. There is no SLR-related operational or aging impact or change that warrants alteration of a licensee's BAC Program. Existing practice is more than adequate and the increased burden does not improve safety.

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

The guidance to provide technical justification for not removing obstructions to visual inspections is directly from Westinghouse Commercial Atomic Power (WCAP)-15988, Revision 2, Mandatory Objections, Section 4.2, Obstructions to Visual Inspections, which states "The objective of this element is to ensure that obstructions to visual inspections shall be removed for inspection, unless a technical justification for not performing the visual inspection is prepared." While the program expectations provided in SLR may be new to the GALL AMP, they are consistent with the existing mandatory objective in the WCAP document. If an applicant's program is not consistent with the guidance in the GALL AMP, an exception can be taken.

<u>Comment</u>: <u>046</u>

XI.M10 Element 5 - Page XI.M10-2

Section should be revised to require maintaining a list of active borated water leaks and not all borated water leaks.

Basis:

This paragraph should restrict the list to only active leaks. While many plants record both active and inactive leaks, inactive leaks do not affect structural integrity based on low corrosion rates.

<u>Markup</u>

The program maintains a list of all *<u>active</u>* borated water leaks to track the condition of components in the vicinity of leaks and to identify locations with repeat leakage.

RESPONSE:

The staff partially agreed with the comment. WCAP-15988, Section 7.7, Data Collection and Documentation, states *"A log or database of all borated water leak locations should be maintained for assessment, monitoring, and trending of the following conditions*: *wet (active) leakage, excessive deposit of boric acid, discoloration associated with rust or corrosion, and targets affected that are susceptible to corrosion. Non-active or minor housekeeping conditions should be monitored and trended through normal maintenance procedures or work management processes.*" The staff added "active" leak as recommended, and also added, "excessive boric acid deposits, discoloration caused by corrosion, and affected targets susceptible to corrosion."

5. *Monitoring and Trending*: The program provides monitoring and trending activities as delineated in NRC GL 88-05, timely evaluation of evidence of borated water leakage identified by other means, and timely detection of leakage by observing boric acid crystals during normal plant walkdowns and maintenance. The program maintains a list of all active borated water leaks, excessive boric acid deposits, discoloration caused by corrosion, and affected targets susceptible to corrosion to track the condition of components in the vicinity of leaks and to identify locations with repeat leakage.

Additional conditions that are to be maintained in a list are from WCAP-15988, Section 7.7.

<u>Comment</u>: <u>047</u>

XI.M10 References–Page XI.M10-4

Update the "Boric Acid Corrosion Guidebook" reference from Revision 1 to Revision 2.

<u>Basis</u>:

References should reflect latest industry issued guidance.

RESPONSE:

The staff agrees with this comment. The Boric Acid Corrosion Guidebook, Revision 2, EPRI document (EPRI 1025145), is still not free to the public and the staff has not been provided a copy to review. However, it should be noted that the cited document only appears in the reference section of the AMP. As such, not including the latest revision of the document would not impact any applicant and there would be no need for them to take an exception.

<u>**Comment**: **048**</u>

XI.M11B Element 4 - Page XI.M11-2

A baseline volumetric exam of all susceptible material nickel alloy bottom-mounted instrument nozzles may not be possible due to geometry/accessibility of the components. Industry visual examinations have been proven capable of detecting relevant indications before the effects of aging progress to the point of causing a loss of intended function. Industry recommends deleting this exam from the guidance.

<u>Basis</u>:

If the identified inspections are necessary to assure safety, it is recommended that NRC should work through the ASME process to have such requirements codified. If safety is not an issue and this is being sought for additional data, it is inappropriate. What is inadequate about the existing rules from a plant safety perspective?

The requirement mandates the use of qualified method in accordance with ASME Code Section XI. Such methods have not been developed for many of these locations (bottom-mounted instrument nozzles, branch connections, etc.) To do so would take years of development and significant resources. This seems an undue burden when operating experience has shown little degradation in these locations and the safety need has not been identified.

The term "adequate periodicity" is vague and would likely be a source of conflict. Crisp definitions are needed and adequacy should be based on objective parameters that are consistent with a clearly established safety need.

RESPONSE:

The staff agreed with this comment. The baseline examination provision for bottom-mounted instrumentation (BMI) nozzles is deleted. Existing bare metal visual inspections specified in 10 CFR 50.55a have been effective for aging management. The staff agreed that the current operating experience does not indicate significant aging-related degradation requiring additional inspections.

<u>**Comment**: **049**</u>

XI.M11B Element 4–Page XI.M11-2

A baseline volumetric exam of all susceptible material nickel alloy bottom-mounted instrument nozzles may not be possible due to geometry/accessibility of the components.

<u>Basis</u>:

The MRP's BMN safety assessment, shared with NRC in public meetings, concluded that a program of regular visual examinations for evidence of leakage provides adequate protection against challenges to nuclear safety from BMN degradation. While NRR has not necessarily formally accepted this position, they have rescinded previous efforts through the ASME Code to require BMN volumetric exams.

If “qualified volumetric examination method” is meant to imply an ASME Section XI or PDI-level program, the qualification program itself would be a significant industry burden to develop much less implement. As noted above, it is not necessary to assure safety.

RESPONSE:

The staff agreed with this comment. See the response to Comment 016-048 above.

Comment: **050**

XI.M11B Element 4 - Page XI.M11-2

Include consideration of the PWSCC temperature threshold when recommending baseline volumetric examinations for branch line connections and CRDM housings that typically operate below the 550°F threshold temperature.

RESPONSE:

The staff partially agreed with this comment. GALL-SLR Report 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,” does not address an augmented baseline inspection of control rod drive mechanism (CRDM) housings. Therefore, this comment is not applicable to CRDM housings. With respect to the branch line connections and associated welds, the staff partially agreed with the comment. Consistent with the cold leg operating temperature described in ASME Code Case N-770-1, Inspection Item B, the staff specified a threshold temperature of 274 degrees C [525 degrees F] {instead of 288 degrees C [550 degrees F] as this comment recommended} for the baseline inspection of branch line connections and associated welds. The text below has been added to the AMP:

> The program also performs a baseline volumetric or inner-diameter surface inspection of all susceptible nickel alloy branch line connections and associated welds as identified in Table 4-1 of EPRI MRP-126 if such components or welds are of a sufficient size to create a loss of coolant accident through a complete failure (guillotine break) or ejection of the component <u>and the normal operating temperature of the components is 274 degrees C [525 degrees F] or greater.</u>

Comment: **051**

XI.M11B Element 4–Page XI.M11-2

GALL-SLR recommends a baseline volumetric or inner-diameter surface inspection for all susceptible nickel alloy branch line connections and associated welds as identified in Table 4-1 of MRP-126 if such components or welds are of a sufficient size to create a loss of coolant accident (LOCA) through a complete failure (guillotine break) or ejection of the component. Industry visual examinations have been proven capable of detecting relevant indications before the effects of aging progress to the point of causing a loss of intended function. Industry recommends deleting this exam from the guidance.

Source 016

Basis:

The need for examining these locations were considered in the development of Code Case N-770 through the ASME process. The committee did not choose to require such volumetric examinations. NRC chose to interpret the code requirements differently and conclude a volumetric examination was required for some branch connections. NRC's position was documented in RIS 2015-10 and ASME's position is documented in Interpretation XI-1-13-27. Given the opposing views, the ASME committee opened an action to further evaluate the situation. Analyses are underway to determine what if any locations should be examined volumetrically. The analysis is due mid-2016 and will be used in consideration of revising code rules. Therefore since the locations under consideration are within the systems subject to ASME Section XI provisions and the ASME code committee (which includes industry and NRC as stakeholders) is currently evaluating this issue and since the resolution will be documented in the ASME code publications and since NRC is obligated to use the ASME Section XI code in its rulemaking, the recommendation above should be removed from the GALL-SLR. The issue should be resolved through the ASME committee process and NRC's routine rulemaking. If the ASME committee process and NRC's routine rulemaking processes identify any GALL-SRP AMP changes, the changes should be incorporated using the ISG process.

RESPONSE:

The staff did not agree with this comment as discussed in the response to Comment 014-005. The operating experience discussed in RIS 2015-10 indicates that applicants or licensees may have not examined branch line connections using a volumetric or surface inspection method. The staff finds that the baseline inspection provision in GALL-SLR Report 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," is necessary to confirm that primary water stress corrosion cracking (PWSCC) is not occurring in the branch line connections. GALL-SLR Report AMP XI.M11B also clarifies that existing periodic inspections (e.g., inservice inspection) may be credited for this baseline inspection.

Comment: 052

XI.M12 Program Description, Page XI.M12-1, second paragraph

Pump casings should be treated the same as valve bodies and not require screening or guidance addressing pump casings should be added.

Basis:

In accordance with letter dated May 19, 2000, from Christopher Grimes, Nuclear Regulatory Commission (NRC), to Douglas Walters, Nuclear energy Institute (NEI) screening for susceptibility to thermal aging embrittlement is not required for pump casings and valve bodies.

The above letter states under Valve Bodies and Pump Casings (page 9):

"Valve bodies and pump casings are adequately covered by existing inspection requirements in Section XI of the ASME Code, including the alternative requirements of ASME Code Case N-481 for pump casings. Screening for susceptibility to thermal aging is not required and the current ASME Code inspection requirements are sufficient."

Note that the May 19, 2000 Grimes letter provided screening exclusions that referenced Code case N-481, which has been annulled. By practice, ASME Section XI code cases are annulled when the appropriate provisions of the case have been incorporated into the Code and that edition/addenda of the code has been endorsed by NRC in 10 CFR 505.55a. Since N-481 has been annulled, the conclusion is the code committee incorporated the appropriate elements of the case into the code itself. Further, it was in an edition or addenda NRC has endorsed in 10 CFR 50.55a. Since ASME did not include the screening for susceptibility provisions of the code case in the code and since NRC did not condition the use of the code it is logical to conclude that the screening is not needed. As such, the use of the code case should be dropped from GALL-SLR and Section XI as written is adequate for use. Screening of CASS pump casings for thermal embrittlement susceptibility should not be needed, ASME code inspection requirements are sufficient.

In addition, pump casings (B-L-2) and valve bodies (B-M-2) are included in ASME Section XI Table IWB-2500-1 and require a visual, VT-3 inspection and acceptance standard IWB-3519.

Markup

For *pump casings and* valve bodies, based on the results of the assessment documented in the letter dated May 19, 2000, from Christopher Grimes, Nuclear Regulatory Commission (NRC), to Douglas Walters, Nuclear Energy Institute (NEI) (May 19, 2000 NRC letter), screening for significance of thermal aging embrittlement is not required. The existing ASME Code, Section XI inspection requirements are adequate for *pump casings and* valve bodies. **RESPONSE**:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The staff modified the AMP to include a visual inspection and test frequencies are adjusted based on inspection and test results, as well as, plant-specific operating experience.

The exemption of pump casings was based upon implementation of Code Case N-481 requirements by licensees, which included a VT-3 when pumps were disassembled of the pump interior, VT-2, and VT-1 exam of one pump weld. In addition, Code Case N-481 required a "safety and serviceability evaluation." When Code Case N-481 was withdrawn, some but not all the requirements of the code case were incorporated into the ASME Code, Section XI. Therefore, since some of the requirements, specifically the VT-1 examination and the safety and serviceability evaluation, were not incorporated into Section XI, the staff determined it was appropriate for pump casings to be subject to the same requirements as piping components. The basis for exempting valve bodies from the requirement for screening was different than that for pumps. A generic flaw tolerance evaluation was used as the basis for exempting valve bodies, not Code Case N-481. Therefore, valve bodies continue to be exempt from screening in GALL-SLR Report AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," for SLR.

Comment: 053

XI.M12 Description of Program, Table XI-01, Page XI 01-25

AMP XI.M12, Thermal Aging Embrittlement of CASS Description of Program should read as shown in Markup section.

Source 016

Basis:

Changes to Table XI-01, XI.M12 Description of Program are to simplify the description and bring it in to better alignment with the GALL-SLR XI.M12 Scope of Program.

Markup

The program consists of the determination of the susceptibility potential *to a significant* ~~*significance*~~ loss of fracture toughness due to thermal embrittlement of *ASME Code Class 1* CASS piping and piping components in both BWR and PWR reactor coolant pressure boundaries ~~*emergency core cooling system (ECCS) systems, including interfacing pipe linesto the chemical and volume control system and to the spent fuel pool; and in BWR ECCS systems, including interfacing pipe lines to the supression chamber spray system in regards to thermal aging embrittlement*~~ based on casting method, molybdenum content, and ferrite percentage. For potentially susceptible piping and piping components aging management is accomplished either through enhanced volumetric examination, enhanced visual examination, or a component-specific flaw tolerance evaluation.

RESPONSE:

The staff agreed that the table entry should align with program description in GALL-SLR Report AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," to include the following sentence: "The scope of the program includes all primary pressure boundary components constructed from CASS with service conditions above 250 degrees C [482 degrees F] at the end of first paragraph of the Program Description." Also see the response to the previous Comment 016-052.

Comment: 054

XI.M16A Program Description

GALL-SLR deletes this program in its entirety, replacing it with a plant-specific AMP per SRP-3.1.3.2.9. The program should be retained and informed as industry and/or staff research discovers revisions, through the applicant's OE program. Consideration should be given to retaining the AMP XI.M16A regarding PWR Reactor Internals aging management, as the existing MRP-227-A-based program for 40-60 years is the most reasonably sound and technical robust aging management program based on proactive inspections and activities to monitor aging mechanisms in the plants.

Bases:

This AMP is based on the results of EPRI program MRP-227 and MRP-227A (the version reviewed and approved by NRC staff). It is based upon component rankings, inspections and evaluations of the effects of age-related processes and degradations.

Even though there may not be any component histories within the 60-80 year range of reactor operations, there is no reason to suspect that the identified aging and aging effects (for 40–60 years) are suddenly discontinuous so that component behavior would be totally unknown and undefinable. Fluence increases, void swelling, IASCC and other known effects can be projected as aging effects into the 60–80 year timeframe and under periodic monitoring just like any other corrosion or aging effect, unless it is known that there exists some discontinuity, some “cliff-effect,” over which the component or effect will precipitously crash without any foreknowledge. Instead, this program should be thought of in a similar manner as a TLAA managed as per 10 CFR 54.21.c.1.iii, in that a systematic set of periodic inspections and associated corrective actions are defined so as to monitor and manage effects of aging of components before any loss of intended functions. Triple-i (iii) treatment is indicated (ref. the VY NRC Commission decisions) for a previously-calculated aging effect but—while it is a known aging effect—it can no longer be calculated; rather it can be managed by a programmatic set of inspections and/or tests, and repaired, replaced or re-evaluated prior to indications of failure. (We are not saying this ought necessarily to be a TLAA, but we are making the point that it can be handled in a manner analogous to a TLAA, where management of components is acceptable even though calculations per se do not exist to show total acceptability for the period of extended operation of 60-80 years.)

These techniques and inspection strategies have been proven over many years both within the BWRVIP and PWR-MRP programs, and will remain the basis for SLR aging management applications as well. As previously noted by industry, this aging management program based upon MRP-227-A is supplemental to the existing ASME Section XI In-Service Inspection programs as detailed by Chapter XI.M1; and its continued use will provide reasonable assurance of the long-term integrity and safe operation of pressurized water reactor (PWR) vessel internal components. Industry has an on-going initiative through EPRI to establish any supplemental requirements to MRP-227-A that may be needed to address the SLR application for 60-80 years life. This effort is expected to be completed in the 2019-2020 time-frame.

Additionally, industry is developing a PWR Internals Position Paper that similarly supports the MRP-227 processes and revisions as the bases for utility aging management efforts.

RESPONSE:

This comment is analogous to the comment made in Comment No. 001 from Source 014 (i.e., as associated with Comment Issue 014-001. The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. The staff agreed that an AMP that employs the methodology in Topical Report No. MRP-227-A may be used as the starting point for an AMP that will be used to manage the aging effects of PWR vessel internals, as long as it is supplemented with a submittal of a gap analysis methodology that identifies the potential changes that may need to be made to the methodology in MRP-227-A in order to account for the additional 20 year of licensed operations that would occur during a subsequent period of extended operations (i.e., to account for a total of 80 years of licensed operations. For more information, refer to the staff’s bases for resolving the comment associated with Comment Issue 014-001.

<u>**Comment**: **055**</u>

XI.M17 Program Title

Change Title to “Flow-Accelerated Corrosion And Other Wall-thinning Erosion-Corrosion Mechanisms”

<u>Basis</u>:

(a) GALL-SLR has expanded this beyond simply “Flow Accelerated Corrosion” and so the name should reflect this. It is a misnomer to name it “FAC” under the proposed guidance. It should be changed to something such as “[FAC] plus erosion management." In addition, since the agency has stated that "since there are no materials that are known to be totally resistant to wall thinning due to erosion mechanisms…" all applicants will in essence be required to analyze and prepare management programs for both types of aging effect. That appears to be an over-reach; instead management of wall-thinning due to erosion should be excludable by an applicant (see below) if there is no real OE for that aging effect at the facility.

(b) NSAC-202L-R4, Recommendations for an Effective Flow-Accelerated Corrosion Program (EPRI Technical Report 3002000563) states in Footnote 1, on page 1-1 that "erosion, it should be noted, is not part of the degradation mechanism." As such the term erosion, if included in this AMP, should be explicitly distinguished from FAC, and handled as such, throughout the AMP.

<u>Markup</u>

The markup provided by this comment was for the entire program in GALL-SLR Report AMP XI.M17 included in pages 52 – 56 of Attachment 3 in the NEI comment letter of February 29, 2016 (ADAMS Accession No. ML16069A068).

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

Sites have had Flow-Accelerated Corrosion (FAC) programs for more than 25 years. During a number of its LRA reviews, the staff noted that applicants were successfully managing erosion mechanisms through their FAC programs and acknowledged the acceptability of this approach by issuing LR-ISG-2012-01, "Wall Thinning Due to Erosion Mechanisms." The intent of LR-ISG-2012-01 was not to require the inclusion of erosion mechanisms in the FAC program, but to allow erosion mechanisms to be included through appropriate changes to the AMP. If the title of the AMP was changed, it would imply that all FAC programs need to include erosion mechanisms. This is not the case. If an applicant has chosen to include erosion mechanisms in the FAC program, then they also may choose to change the title of the AMP if they feel it is appropriate. Otherwise, the staff does not see how changing the title will make any difference for how the program works. In addition, if an applicant believes that the inclusion of erosion mechanisms in the FAC program will cause a problem, a site is not precluded from proposing a plant-specific program if the existing GALL AMP allows the inclusion. In addition, this comment appears to conflict with industry Comment 016-074, which states "the term "Erosion-Corrosion" is an old term that we no longer use. We don't need to use that in the title."

<u>**Comment**: **056**</u>

XI.M17 Program Description–Page XI.M17-1

The AMP should not be extended into coverage of treated water systems. The justification(s) provided do not lead to nor warrant the inclusion. Any erosion mechanisms covered under this AMP should be in secondary and non-treated water systems, involving wall-thinning and limited to management of the aging effects for SSCs within scope of license renewal. This proposed AMP does not seem to observe those boundaries.

Basis:

(a) GALL-SLR continues the program as proposed in LR-ISG-2012-01, in which coverage of “erosion” was justified by citing GALL-R2, 3.2.2.2.4. However that section does not cover wall-thinning mechanisms, rather erosion of an orifice due to high differential pressure over a period of time. That this instance involved borated water was immaterial to the erosion effect. So this is not a justification to extend this AMP to treated (borated) water, or as a justification to postulate erosion due to wall-thinning.

(b) Another instance that does not provide justification is the notification by Westinghouse of ECCS loop injection throttle valves potentially failing over a short period of time due to erosion during LOCA accidents (See IN 97-76, 10/30/1997). That was identified as a short-term mechanism under Part 50.46, and corrected by design change, and furthermore had nothing to do with wall thinning.

(c) If there are examples that justify expanding the program (and there could be, however the commenter does not know them), then those examples should be presented.

(d) Other cases of justification should also be checked and those that do not cover FAC or wall-thinning erosion should be removed for the AMP.

Markup

The markup provided by this comment was for the entire program in GALL-SLR Report AMP XI.M17 included in pages 52 – 56 of Attachment 3 in the NEI comment letter of February 29, 2016 (ADAMS Accession No. ML16069A068).

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

The FAC program has always included treated water systems, in that the NRC’s generic communication prompting this program was a pipe failure in a feedwater system, which is considered a treated water system. In addition, the operating experience relating to erosion mechanisms provided in the AMP (as well as LR-ISG-2012-01, “Wall Thinning Due to Erosion Mechanisms”) included examples of erosion in treated water systems, such as a BWR High Pressure Coolant Injection system, a BWR core spray system, and a PWR feedwater heater. Further staff research identified an additional erosion example in a PWR Component Cooling Water system documented in an early safety evaluation report (SER) for license renewal. The comment citing SRP-SLR Section 3.2.2.2.4 is misapplied because that reference in LR-ISG-2012-01 was only associated with a comment resolution relating to the need for additional guidance on non-particulate-related erosion and was not a basis for including treated water systems. Since the staff did not cite the other references in the comment, there is no need to include any further discussion.

Comment: 057

XI.M17 Program Description–Page XI.M17-1

FAC portions of this AMP need to be limited to FAC susceptible piping.

Source 016

Basis:

Piping is susceptible to FAC if it is subject to temperatures in excess of 200 degrees F.

Markup

…The program includes (a) identifying ~~*all susceptible*~~ piping systems and components susceptible to either mechanism; (b) developing FAC predictive models…

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

In resolving comments for LR-ISG-2012-01, “Wall Thinning Due to Erosion Mechanisms,” the staff previously added clarifications to distinguish which portions of the AMP apply to FAC and which apply to erosion. The proposed mark-up appears to be contrary to the comment because it is combining FAC with non-FAC mechanisms. Although not specifically part of the comment, the basis discussed above is not strictly correct based on EPRI 1013474, “Investigation into Flow-Accelerated Corrosion at Low Temperatures.” The staff notes that although the wear rate for FAC peaks at 149 degrees C [300 degrees F], FAC still occurs at temperatures below 93 degrees C [200 degrees F] as discussed in the cited EPRI document. No further discussion is warranted since this aspect is not specifically associated with the comment.

Comment: 058

XI.M17 Program Description–Page XI.M17-1

Delete the phrase stating “periodic monitoring in lieu of eliminating… mechanisms.”

Basis:

(a) 10 CFR 54 (the Rule)/SOCs specify that the applicant needs to effectively “manage” the “effects” of aging; it is not a requirement that any aging mechanism needs to or is required to be totally eliminated. “Eliminating the cause of” any aging mechanism is beyond the scope of 10 CFR Part 54. This type of reasoning should be eliminated from the AMP and appropriate justification used to align the AMP for effectively **managing** the aging **EFFECT.**

(b) Periodic monitoring is actually an acceptable aging management component. However, the commenter recognizes that more actions may also be needed.

Markup

…This program ~~*may*~~ also manages wall thinning caused by mechanisms other than FAC, in situations where *such mechanisms exist at a facility.* ~~*periodic monitoring is used in lieu of eliminating the cause of various erosion mechanisms.*~~

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

The phrase cited in the comment is in relation to when the FAC program may be used to manage mechanisms other than FAC. Contrary to the basis cited in the comment, if the cause of an aging effect has been eliminated (e.g., through a design change, or a change in operational constraints), then there is no longer a need to manage wall thinning due to erosion mechanism. As a specific example, FAC can be eliminated by component replacement with minimal levels of chromium. Those portions of piping that have been replaced can be excluded from the FAC program. For erosion associated with cavitation or flashing, design changes can effectively eliminate the cause. This is the basis for the statement in EPRI 1010639, "Non-Class I Mechanical Implementation Guidance and Mechanical Tools," that loss of material due to cavitation-erosion is not an applicable aging effect, because it will be detected and corrected during the current term of operation. However, in a number of instances, although the cavitation-erosion was detected, applicants chose not to correct the design deficiency, but instead monitored the affected components for loss of material. By including the discussion about eliminating the cause, the staff is correctly applying the principles of aging management.

Comment: 059

XI.M17 Element 1–Page XI.M17-1

Revise element 1 (and similar parts throughout the elements) to state "the FAC portion of the program…" instead of simply saying "the FAC program…"

Basis:

Since two distinct mechanisms are being incorporated into one AMP, the AMP should use a consistently parallel construct throughout in order to distinguish when the FAC mechanism is being discussed and when the wall-thinning via erosion mechanism is being discussed.

Markup

The markup provided by this comment was for the entire program in GALL-SLR Report AMP XI.M17 included in pages 52 – 56 of Attachment 3 in the NEI comment letter of February 29, 2016 (ADAMS Accession No. ML16069A068).

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

In resolving comments for LR-ISG-2012-01, "Wall Thinning Due to Erosion Mechanisms," the staff previously added clarifications to distinguish which portions of the AMP apply to FAC and which apply to erosion. Program elements for Detection of Aging Effects, Monitoring and Trending, and Corrective Action currently cite "For FAC," and "For erosion mechanisms," which adequately distinguish between the different activities associated with each portion of the AMP. The staff does not see a need to include a further specific distinction in the Scope of Program program element because it currently includes a statement that the program may also include components subject to wall thinning due to erosion.

Source 016

<u>Comment</u>: **<u>060</u>**

XI.M17 Element 1–Page XI.M17-1

Lines 19-22 are incorrect since the term “high-energy” is deleted. Re-insert the term “high-energy” into the definition of FAC to accurately align to NSCA-202L.

<u>Basis</u>:

In revising this sentence the staff has made it incorrect; the FAC program in NSAC-202L limits FAC to **<u>high-energy</u>** systems, and LR-ISG-2012-01 eliminated that phrase for GALL-R2.

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

Contrary to the comment, NSAC-202L states “Systems, or portions of systems, should not be excluded from evaluation based on low pressure. Pressure does not affect the level of FAC wear. Pressure only affects the level of consequence should a failure occur.” This was specifically considered in LR-ISG-2012-01, “Wall Thinning Due to Erosion Mechanism,” which states: “…the reference to high-energy systems was deleted in the ‘scope of program’ to better align the AMP with the more accurately stated scope of NSAC-202L-R2 or -R3.”

The staff notes that NSAC-202L, Revision 4, also contains the same statement. LR-ISG-2012-01 also noted that the term “high-energy” is not consistently defined and although it was the initial focus of the NRC’s generic communication in this area, NSAC-202L Revision 2 and Revision 3 state “failure in a low-pressure system could have significant consequences.”

<u>Comment</u>: **<u>061</u>**

XI.M17 Element 1–Page XI.M17-1

Lines 25-27: The scope for wall-thinning due to erosion should be limited to non-treated water systems. In revising this sentence the staff has made it incorrect; the FAC program in NSAC 202L limits FAC to high-energy systems, and LRISG-2012-01 eliminated that phrase for GALL-R2.

<u>Basis</u>:

If there are no OE examples that show an industry trend for wall-thinning of pressure boundaries due to erosion in treated water systems, then they should be excluded from scope. If there are examples, then those should be added to the GALL-SLR to support the inclusion. (Since this is a **<u>new</u>** GALL for SLR and not simply a revision to GALL-R2, comments on this issue should again be applicable.) For treated water systems where particulates are controlled any erosion would only be due to cavitation, droplet impingement or flashing. The staff’s response in 2012-01 was not convincing, since the two examples given by the staff involved neither FAC nor flow erosion: rather cavitation (the eroding of an **<u>orifice</u>** not the walls) and impingement in a 2-phase environment (SG FW impingement plates), sections 3.2.2.2.4 and 3.1.2.2.8. Neither one deals with **<u>wall-thinning due to erosion</u>**, so neither one supports the argument and neither should pertain to this discussion. The FW plates effect is apparent only for 1 or 2 Westinghouse SG designs with a bottom-mounted FW preheater, so it is not appropriate to extend this peculiarity to apply as an ostensibly industry-wide issue; in any case this impingement is not wall-thinning of piping or a pressure boundary due to erosion. If there are no OE examples that show an industry trend for wall-thinning of pressure boundaries due to erosion in treated water systems, then they should be excluded from scope. If there are examples, then those should be added to the GALL-SLR to support the inclusion.

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

The basis of the comment is flawed, because the Operating Experience section currently includes LER 277/2006-003, which addresses erosion in a treated water system. The LER is associated with the torus flush line for the High-Pressure Coolant Injection/Reactor Core Isolation Cooling systems, which are treated water systems. According to the LER, the leak was "due to cavitation and abrasive erosion and/or localized water-jet cutting resulting from excessively high flow velocities through this piping during test conditions." However, the staff does agree that the resolution of the comment for LR-ISG-2012-01, "Wall Thinning Due to Erosion Mechanisms," was weak and in order to provide additional clarification, that staff will revise the Operating Experience section to include LER 374/2013-001, which addresses leaks in the High Pressure Core Spray system (a treated water system), due to "a combination of cavitation and mechanical wear/erosion of the pipe wall." As further emphasis to this point, the staff notes that one of the initial operating experiences that contributed to the initiation of LR-ISG-2012-01, was the leak in the stainless steel pipe for the High Pressure Safety Injection pipe (also a treated water system) at the Palo Verde Nuclear Generating Station. A more detailed description of this operating experience is documented in the final Safety Evaluation Report (SER), Section 3.0.3.2.2 (ADAMS Accession No. ML110110411) with further information in Palo Verde Nuclear Generating Station (PVNGS) Commitment Change letter dated September 18, 2015, wherein the licensee reverted to performing periodic condition-based monitoring for cavitation erosion (see ADAMS Accession No. ML15261A882).

<u>Comment</u>: <u>062</u>

XI.M17 Element 1–Page XI.M17-1

Lines 25-29 should include phrasing to denote that wall-thinning erosion should be included only for facilities that have instances or OE-related to it for reasons stated in Comment 7.

<u>Basis</u>:

Furthermore, the sentence should add that components in the scope of second license renewal are contemplated. It is immaterial to the AMP if non-scope components are monitored or managed for this aging effect.

<u>Markup</u>

…The program ~~may~~ also include<u>s</u> components that are subject to wall thinning due to erosion mechanisms such as cavitation, flashing, droplet impingement, or solid particle impingement in various water systems <u>*if there is OE of this nature at the facility*</u>. Since there are no materials that are known to be totally resistant to wall thinning due to erosion mechanisms, ~~*susceptible*~~ components <u>*of any material and within the scope of license renewal*</u> ~~*of any material*~~ may be

~~included~~ susceptible and exhibit erosion, which would then be managed in the erosion portion of the program.

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

The staff's intent for inclusion of components in this AMP that are being managed for erosion mechanism was not to require that they be managed by this program, but to allow these components to be included in this program. Erosion is clearly included within the scope of Generic Letter 89-13 and consequently within the scope of GALL-SLR AMP XI.M20, "Open-Cycle Cooling Water System." The staff did not intend to require components being managed for erosion in GALL-SLR AMP XI.M20 to be managed by GALL-SLR AMP XI.M17, "Flow-Accelerated Corrosion." As noted in the resolution of comments for LR-ISG-2012-01, "Wall Thinning Due to Erosion Mechanisms," (No. 1-38), the final version of the AMP deleted the phase "if the erosion mechanisms are not being managed by another program" as requested by the industry. The staff had initially included this phrase in recognition of other AMPs.

Comment: **063**

XI.M17 Element 1–Page XI.M17-1

Further comments on Element 1.

Basis:

(a) In further consideration of systems that ought not to be in scope, one would not expect (nor has the commenter heard of any) either FAC or erosion to be occurring in a PWR reactor coolant system, however it is a high-energy, high flow system, yet is treated water and has extremely low dissolved O^2 and no particulate or suspended materials to speak of. Nor in the pressurizer where there is two-phase water–water and steam—yet low flow and again, low O^2 and no particulate. Neither in downstream tailpieces of the PORVs nor safety valves, where there would be (if any flow) two-phase high-energy flow, yet very infrequently and not enough time at those flow conditions to cause detectable erosion.

(b) Why should applicants have to prove for their facility, that erosion is not occurring for these types of systems? It should be sufficient that, if an erosion condition occurred or has some indications based upon relevant plant OE (or even a "twin" or similar plant where those conditions could also reasonably exist at the applicant facility), in other words, if there is truly relevant OE or occurrences then for those systems and components, either examine to see if you have the erosion (and document not having it) or monitor and manage it under the AMP because the situation is a real one for your facility. Perhaps this is what the staff has in mind but the scope appears much more broad to this commenter than that, and so that's why the comment is made here.

(c) On the other hand, there may be cases where in a service water system, for example, erosion downstream of a flow control valve may cause wall thinning of the pipe, and so that situation needs to be managed under the new AMP as a flow erosion (not FAC). The commenter would agree that that situation needs either managing under this AMP or some sort of design change to resolve it. If the design change indeed resolves it, then following a period of successful confirmation, no more erosion aging management should be needed for that location.

RESPONSE:

The staff agreed with aspects of the comment bases.

The staff added “if the erosion mechanisms are not being managed by another program” in the first sentence of the AMP description.

Bases comment (a): The staff notes that there are no ARM items listed in GALL-SLR Report Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System Tables A2, B2, B3, B4, or C2 for PWRs and there are no references in “scope of program” program element indicating that components exposed to PWR reactor coolant system are required to be managed for erosion by the program.

Bases comment (b): The staff did not agree that the AMP will cause applicants to “prove…that erosion is not occurring for these types of systems. The Detection of Aging Effects program element includes a discussion about the inclusion of erosion mechanisms based on extent of condition reviews for corrective actions in response to plant-specific and industry operating experience.

Bases comment (c): The staff agreed with this discussion and that the need to manage erosion mechanisms can be managed by this AMP if they are not being managed by another AMP.

Comment: 064

XI.M17 Element 2–Page XI.M17-1

Lines 30-31 should be revised to reflect the FAC “portion” of the program. Add a similar statement for the “erosion portion”–it is condition monitoring (or, staff chooses the type). Also, Technical Issues Input form GALL-48 for AMP XI.M17 was not addressed, i.e., the phrase “monitoring of water chemistry to…” was not removed from Element 2.

Basis:

(a) MP should manage two aging effects is fine, but the AMP should drop the phrases like “may include components” or “may be used to manage…erosion” and simply state that both issues are the intended scope and purpose of this SLR AMP.

(b) As explained for lines 25-29 above, this AMP is actually designed in such a way that an applicant must inspect and test virtually all water systems in the plant to show that something is not occurring. Unless limited to those occurrences of erosion at the facility, this is too broad of a reach. This commenter does not contest the staff desire to have the AMP cover two things; however, the statement also means that all applicants would need to perform AMRs on virtually all piping systems, both treated and untreated water, primary and secondary, to show that either erosion is not happening at all in their plant or that they are managing it via the AMP, unless the scope can be narrowed to what occurs at the facility if the facility has such occurrences… which is how this scope should be designed to cover.

(c) Previous comment continued: While it is true that (as was stated in staff responses to ISG 2012-01) one could say that an applicant may always propose a plant-specific AMP or items, that response contributes nothing to objective, reasoned discussions of which way is the appropriate way to design an AMP. The staff is giving clear indication that it prefers the AMP to be designed as proposed in GALL-SLR, unless of course the applicant desires an indefinite number of RAI rounds and questions and subsequent re-work. So, the AMP should be revised to simply treat the topic as the 2-part AMP that is being presented, with balanced discussions of each mechanism and its management

(d) Furthermore, aging management, under the Rule, was not intended to identify and propose "materials known to be totally resistant to" any aging mechanism—the intent is to identify and manage the **effects** of aging—so this type of justification should be removed from the AMP and suitable justifications that are consistent with the Rule inserted instead.

Markup

The markup provided by this comment was for the entire program in GALL-SLR Report AMP XI.M17 included in pages 52 – 56 of Attachment 3 in the NEI comment letter of February 29, 2016 (ADAMS Accession No. ML16069A068).

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made.

Since the condition monitoring aspect applies to both the FAC portion and the erosion portion of the program, adding the distinction proposed by the comment will cause unnecessary redundancy. However, in order to eliminate any misperception, the first sentence will be modified to delete "FAC program." Relating to the comment about deleting "monitoring of water chemistry to…" the staff notes that this phraseology has been carried forward from GALL Report, Revision 1 and GALL Report Revision 2, and acknowledges that NEI's same previous comment was not incorporated. Relevant changes to water chemistry are included in the Parameters Monitored or Inspected program element, so the staff does not consider the inclusion of "monitoring of water chemistry" as being misleading and does not see a need to remove this phrase.

Basis:

(a) The staff disagreed with the comment regarding removal of "may include" or "may be used" because the words were intended to provide flexibility to applicants that have chosen to use this AMP for managing wall thinning due to erosion mechanisms. Removing these wording as suggested would remove the intended flexibility.

(b) The staff disagreed with the comment's misperception that the program is designed to "inspect and test virtually all water systems in the plant to show that something is not occurring." As stated in the Detection of Aging Effects program element, "For erosion mechanisms, the program includes the identification of susceptible locations based on the extent-of-condition reviews from corrective actions in response to plant-specific or industry operating experience."

(c) The staff maintains its previous statements that an applicant can propose a plant-specific AMP and notes that prior to the issuance of LR-ISG-2012-01, “Wall Thinning Due to Erosion Mechanisms,” a number of applicants had chosen to include erosion mechanisms within the Flow-Accelerated Corrosion program but these did not result in “an indefinite number of RAI rounds and questions and subsequent rework.” In addition, the reason the staff has included “may include” or “may be used” in the current AMP is to allow applicants the flexibility with the program instead of prescribing a fixed approach.

(d) The staff agreed that the intent of the AMP is to manage the effects of aging; however, the statement about “no materials being totally resistant to erosion mechanisms in the “Scope of Program” program element is to make it clear that, unlike FAC, material substitution does not necessarily eliminate the aging effect.

Comment: 065

XI.M17 Element 2–Page XI.M17-1

Technical Issues Input form GALL-48 for AMP XI.M17 was not addressed, i.e., the phrase “monitoring of water chemistry to…” was not removed from Element 2. The phrase “monitoring of water chemistry to control” in line 32 of element 2 should be deleted in favor of “controlling pH and dissolved oxygen…”

Basis:

The phrase implies this AMP is also required to monitor chemistry parameters outside of the monitoring performed by XI.M2, Water Chemistry. Making the edit retains the recommendation for control of the parameters without introducing the potential confusion of which program needs to be central in the monitoring and tasks related to water chemistry.

Markup

…However, it is noted that *monitoring of water chemistry to control* controlling pH and dissolved oxygen content are effective …

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

The Parameters Monitored or Inspected program element states that “relevant changes in system operating parameters, (e.g., temperature, flow rate, water chemistry, operating time), that result from off-normal or reduced-power operations are considered for their effects on the FAC models.” The activities in this AMP do not include the monitoring of each of these parameters for each in-scope system; however, program activities should ensure that changes in these parameters that come from other monitoring activities are factored into the FAC models. In addition, the staff does consider this wording as introducing confusion, because “monitoring of water “chemistry to control pH and dissolved oxygen content” has been in place since GALL Revision 0.

Comment: 066

XI.M17 Element 4–Page XI.M17-2, Lines 25-26

Lines 25-26, delete “before the loss of intended function” and replace with “in accordance with minimum wall requirements per the construction Code or ASME Code, Section XI.”

Basis:

Minimum wall requirements per the construction Code or ASME Section XI have been used by the industry in the determination of the extent and the schedule of inspection, not the loss of intended function.

Markup

The extent and schedule of the inspections ensure detection of wall thinning ~~*before the loss of intended function*~~ in accordance with minimum wall requirements per the construction Code or ASME Section XI.

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

The discussion in the Detection of Aging Effects program element is consistent with the guidance in SLR-SRP Appendix A, Section A.1.2.3.4, item 4, regarding the technique and frequency used to detect aging effects before a loss of system/component intended function occurs. The staff acknowledges that Code-required minimum wall thicknesses are used in the program and these are specifically included in the Acceptance Criteria program element. It is clear that by using the acceptance criteria specified in Acceptance Criteria program element, the program “ensures detection of wall thinning before the loss of intended function” occurs as stated in the Detection of Aging Effects program element.

Comment: 067

XI.M17 Element 4–Page XI.M17-2, Lines 32-33

In the section “Detection of Aging Effects”–Line 32 references an old EPRI report (1011231) dated 2004 for identifying potential damage locations due to erosion mechanisms. A more current document for identifying erosion locations dated 2010 is EPRI report 1022187 entitled “Plant Susceptibility Screening for Erosive Attack.” The more recent EPRI report should be referenced in this sentence and to clarify the applicability to erosion mechanisms.

Basis:

Editorial

Markup

For erosion mechanisms, the program includes the identification of susceptible locations based on the extent-of-condition reviews from corrective actions in response to plant-specific and industry operating experience. Components in this category may be treated in a manner similar to other “susceptible-not-modeled” lines discussed in NSAC-202L. EPRI *1022187* provides guidance for identifying potential damage locations *due to erosion mechanisms*. EPRI TR-112657 or NUREG/-CR6031 provides additional insights for cavitation. For cavitation, in addition to wall-thinning, the extent-of-condition review may need to consider the consequences of vibrational loading caused by cavitation.

RESPONSE:

The cited EPRI document (EPRI 1022187) has not been provided to the staff to review. No changes have been made.

Comment: 068

XI.M17 Element 5–Pages XI.M17-2 and XI.M17-3

The two paragraphs here are examples of good parallel treatment of the two different mechanisms being managed. One would strongly request the staff to review and improve other sections, so that this type of equal treatment is presented throughout the AMP.

RESPONSE:

The staff agreed with the comment, but considers that adequate delineation between FAC and erosion is already present. No changes to the AMP are needed in response to this comment.

As part of LR-ISG-2012-01, “Wall Thinning Due to Erosion Mechanisms,” the staff resolved an industry comment pertaining to this issue. The staff determined that distinctions were needed in the Detection of Aging Effects, Monitoring and Trending, and Corrective Actions program elements.

Comment: 069

XI.M17 Element 10–Pages XI.M17-5

Revise first sentence to refer that for FAC, problems in high-energy single-phase systems have occurred (further statements can be made for FAC and two-phase flow, or wall-thinning due to erosion mechanisms…)

Basis:

a. For FAC, the term “high energy” should be retained as it is for NSAC-202L.

b. The staff deleted the term “high energy” from the scope of the AMP yet the first three examples cited here in Element 10 are exactly that.

Markup

The markup provided by this comment was for the entire program in GALL-SLR Report AMP XI.M17 included in pages 52 – 56 of Attachment 3 in the NEI comment letter of February 29, 2016 (ADAMS Accession No. ML16069A068).

Source 016

RESPONSE:

No changes to the AMP are needed in response to this comment.

Although NSAC202L does cite "high energy" lines, it is only in the context of criteria for selecting inspection locations. Contrary to the comment statement, "the term 'high energy' should be retained as it is for NSAC 202L", NSAC 202L, Revision 4 states: "Systems, or portions of systems, should not be excluded from evaluation based on low pressure. Pressure does not affect the level of FAC wear. Pressure only affects the level of consequence should a failure occur." Although some of the NRC's generic communications may have initially focused on "high energy," low pressure systems should not be excluded from the scope of the Flow-Accelerated Corrosion program, as cited by NSAC 202L. In addition, although the program's operating experience includes high energy lines, the GALL-SLR Report should not be used for scoping and screening because those aspects are addressed in SRP-SLR, Section 2.0, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review and Implementation Results."

Comment: 070

XI.M17 Element 10–Pages XI.M17-5, Lines 8-9

Better examples need to be cited—not ones that have a dubious relationship to the point being justified—for use in justifying the AMP here.

Basis:

(a) Many of the systems/components listed here (such as most of the PWR feedwater, and virtually all of the condensate systems) are not within the scope of license renewal, so their use to justify an AMP seems dubious at best.

(b) If these systems/components are not within the scope of license renewal, then the staff should not necessarily expect them to be a part of the AMP. The applicant of course may be managing them anyway for economic and personnel safety reasons, but those reasons do not per se place these components within the scope of Part 54 nor under aging management from the AMP.

(c) IE bulletin 87-01 deals with high-energy systems (hot, pressurized condensate and feedwater piping); IN 92-35, high-energy FW piping inside a BWR containment (hot, pressurized); 95-11, hot pressurized condensate (heater drain flows); the impression is that once again, high-energy systems are in focus yet the staff deleted that term from this proposed AMP. Unless adequate justification is presented otherwise, the term high-energy should be retained for FAC. (Note that there may still be justification for low energy fluid systems having wall-thinning erosion, so no adjustment requested for that).

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

Basis:

(a) The specific systems that are included within the scope of license renewal are plant-specific and to delete Operating Experience that has been part of this AMP since 2005 does not appear to be justifiable.

(b) Contrary to the comment implications, the operating experience discussions for AMPs are not intended to be used for scoping and screening of systems. Those aspects are addressed in SRP-SLR, Section 2, “Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review and Implementation Results.” The applicability of operating experience to systems beyond those specifically cited in the Operating Experience program element is a key aspect of operating experience considerations.

(c) NSAC 202L, Revision 4 states “Systems, or portions of systems, should not be excluded from evaluation based on low pressure. Pressure does not affect the level of FAC wear. Pressure only affects the level of consequence should a failure occur.” Although some of the NRC’s generic communications initially focused on “high energy,” low pressure systems should not be excluded from the scope of the Flow-Accelerated Corrosion program, as cited in NSAC 202L.

Comment: 071

XI.M17 Element 10–Pages XI.M17-4, lines 11-12

Add the qualifying phrase “for single-phase, low energy fluids”

Basis:

This discussion pertains to the wall-thinning due to erosion, and so the qualifier should be added to clarify that.

Markup

The markup provided by this comment was for the entire program in GALL-SLR Report AMP XI.M17 included in pages 52 – 56 of Attachment 3 in the NEI comment letter of February 29, 2016 (ADAMS Accession No. ML16069A068).

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

Since flashing and cavitation are not by definition single phase, and the definition of low energy is not consistently established anywhere, the staff does not see a need to include the proposed qualifier. The sentence already clarifies that the subsequent Operating Experience are due to mechanisms other than FAC and further qualification may cause confusion instead of clarification.

Source 016

Comment: 072

XI.M17 Element 10–Pages XI.M17-4, lines 14-15

Vibrational loading is not pertinent to the AMP, so it should be deleted. This also affects Element 4, XI.M17-3, lines 34-35.

Basis:

Cavitation/second-order effects that are not directly wall thinning or pressure boundary thinning are not within the stated scope of this AMP as given in GALL-SLR. While such vibrational loading due to cavitation erosion of a flow orifice's opening (such as GALL-SLR 3.2.2.2.3) could be an issue in initiating for example, a crack in a nearby small-bore piping weld, one should not expect this AMP to manage that cracking. That issue should be addressed in a more appropriate place.

Markup

The markup provided by this comment was for the entire program in GALL-SLR Report AMP XI.M17 included in pages 52 – 56 of Attachment 3 in the NEI comment letter of February 29, 2016 (ADAMS Accession No. ML16069A068).

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. As noted, vibrational loading due to cavitation does not cause wall thinning and should not be included in this program. Considerations for vibrational loading due to cavitation can be addressed through the Corrective Action program element and any subsequent cracking can be appropriately dispositioned through Reactor Oversight Program inspections during IP 71152, "Problem Identification and Resolution."

Comment: 073

XI.M17 References, Page XI.M17-4

On lines 27, 28 & 29, Delete reference for EPRI 1011231 and replace with EPRI 1022187.

Basis:

Current revision of EPRI standard.

Markup

EPRI 1022187, "Plant Susceptibility Screening for Erosive Attack." Palo Alto, California: Electric Power Research Institute. November 2010.

RESPONSE:

The staff did not agree with the comment. EPRI 1022187, "Plant Susceptibility Screening for Erosive Attack," is not available for staff's review. The cited EPRI document (EPRI 1022187) is still not free to the public and the staff has not been provided a copy to review. The intent of including the previous version of document was as a general guidance for the erosion aspect associated with LR-ISG-2012-01, “Wall Thinning Due to Erosion Mechanisms,” and not every site will use the erosion portion of GALL-SLR AMP XI.M17, “Flow-Accelerated Corrosion.”

<u>Comment</u>: <u>074</u>

XI.M17 All Elements, Pages XI.M17-1 through XI.M17-4

Leave the term “may” in the various locations that it is and add it to all other places that mention managing wall thinning due to erosion.

<u>Basis</u>:

The way the AMP is worded now is acceptable. We would prefer it is made clear that the program is the FAC program but it is acceptable to manage wall thinning due to erosion using this AMP if desired. To do that, Volume 1 line items that specify the FAC program for managing erosion should be followed by an identical line specifying a Plant Specific Program requiring further evaluation. Any statements in the SER or elsewhere in the GALL that imply that only the FAC Program can be used to manage erosion, should be clarified. However, the issue boils down to who manages the program. It’s clear to us that the entire industry is going to eventually have to look for erosion mechanisms in plant systems beyond those susceptible to FAC and the current wording gives some flexibility in who does it. Also, the term “Erosion-Corrosion” is an old term that we no longer use. We don’t need to use that in the title.

RESPONSE:

The staff partially agreed with this comment. The GALL-SLR Report has not been changed.

The staff agreed that the term “erosion-corrosion” is an old term and notes that it was Comment 016-055 that proposed adding that term to the title. LR-ISG-2012-01, “Wall Thinning Due to Erosion Mechanisms,” acknowledged this issue with using the term “erosion-corrosion”, and changed the definition of flow-accelerated corrosion in Table IX.F to eliminate the use of “erosion corrosion.” The only other occurrences of the term are in the titles of previously published documents, which cannot be changed.

<u>Comment</u>: <u>075</u>

XI.M18 Element 3–Page XI.M18-2

Revise this element to say, “Specifically, bolting for safety-related <u>*and non-safety related*</u> pressure retaining components is inspected for <u>*signs of*</u> leakage<u>.*”*</u>

<u>Basis</u>:

The words (“surface discontinuities and imperfections, and clearances and physical displacements for signs of loose joints”) are much more intrusive than the ASME Section XI Leak Test VT-2 inspection requirements for Class 1 pressure retaining components, which requires inspection only for leakage.

The closure bolting on many safety related pressure retaining components (potentially thousands) are insulated, operate at high temperatures, are located in containment, may be located at elevations above the operating deck, and may be located in areas of the plant with high radiological exposures. As a result, inspection for: "surface discontinuities and imperfections, and clearance and physical displacements for sign of loose joints" may require the removal of insulation, erection of scaffolding, high radiological exposure, asbestos abatement, system outages, erection of lighting, and other measures to ensure personnel safety. These measures are unnecessary and could impact personnel safety. As an alternative, inspection of safety related safety-related pressure retaining components for leakage (consistent ASME Section XI Leak Test requirements), System Manager walkdowns to identify joint leakage, and relying on existing containment unidentified leakage instrumentation is more reasonable and has less impact on personnel safety.

Markup

Specifically, bolting for safety-related *and non-safety related* pressure retaining components is inspected for *signs of* leakage.~~*, surface discontinuities and imperfections, and clearances and physical displacements for signs of loose joints. Bolting for other pressure retaining components is inspected for signs of leakage.*~~

RESPONSE:

The staff agreed with this comment. See the response to Comment 014-008 for the basis for this response.

GALL-SLR AMP XI.M18, "Bolting Integrity," was revised to be clear that with the exception of volumetric examinations for high strength bolting, visual inspections for leakage are conducted of all closure bolting. However, closure bolting that is submerged or where the piping systems contains air or gas for which leakage is difficult to detect, or closure bolting for components that are not normally pressurized are inspected or tested by alternative means. The Detection of Aging Effects program element provides specific recommendations for inspecting these closure bolts. See the response to comment No. 014-008 for the basis for this response.

Comment: 076

XI.M18 Element 4–Page XI.M18-2, Lines 29-37

Provide alternative recommendations for when bolts of a specific material/environment grouping do not become available during maintenance for bolt thread inspection in a ten year period. This could be to: (1) consider pump and system performance as an indication of joint leakage, and (2) diver inspection of the submerged bolts.

Basis:

Most submerged closure bolting is located on submerged pumps. The following words suggest that inspection of submerged bolting is performed opportunistically during maintenance activities (when bolt heads are accessible and bolts are disassembled):

Bolting in locations that preclude detection of joint leakage, such as in submerged environments, is visually inspected for loss of material during maintenance activities. In this case, bolt heads are inspected when made accessible, and bolt threads are inspected when joints are disassembled".

However, the following words suggest that within a ten-year period a minimum of 20 percent of the bolts up 25 bolts (per material environment group) must be disassembled for the sole purpose of inspecting bolt threads:

At a minimum, in each 10-year period during the subsequent period of extended operation, the program includes the inspection of a representative sample of 20 percent of the population of bolt heads and threads (defined as bolts with the same material and environment combination) or a maximum of 25 bolts per population at each unit."

This suggests that if a specific submerged bolting material/environment population does not become available during maintenance in a ten period, then 20% up to 25 bolts in this grouping must be removed from the submerged environment and dissembled for the sole purpose inspecting the bolt threads. This seems to be an unreasonable recommendation.

Alternate recommendations to when bolts of a specific material/environment grouping do not become available during maintenance for bolt thread inspection in a ten-year period could be to: (1) consider pump and system performance as an indication of joint leakage, and (2) diver inspection of the submerged bolts.

Markup

Bolting in locations that preclude detection of joint leakage, such as in submerged environments, is visually inspected for loss of material during maintenance activities. In this case, bolt heads are inspected when made accessible, and bolt threads are inspected when joints are disassembled. At a minimum, in each 10-year period during the subsequent period of extended operation, the program includes the inspection of a representative sample of 20 percent of the population of bolt heads and threads (defined as bolts with the same material and environment combination) or a maximum of 25 bolts per population at each unit. *If opportunistic maintenance activities do not provide access to 20 percent of the population (for a material/environment combination) up to a maximum of 25 bolt heads and threads over a 10-year period, then other activities such as diver inspections and pump performance may be considered,*…

RESPONSE:

The staff partially agreed with this comment. The Detection of Aging Effects program element was revised to provide alternative recommendations for inspections of submerged closure bolting, closure bolting where the piping systems contains air or gas, and closure bolting for components that are not normally pressurized.

The staff revised the AMP to provide examples of alternatives to disassembly of submerged closure bolting joints. The staff did not agree with the industry's proposal that diver inspections are adequate because diver inspections would only encompass inspection of the head of the bolt. The alternatives provided as examples include performance-based methods of demonstrating reasonable assurance of the joints integrity. Given that alternatives would be based on plant-specific configurations, the AMP states that the SLRA states how integrity of the bolted joint will be demonstrated.

The staff also included recommended inspection methods for closure bolting where the piping systems contains air or gas for which leakage is difficult to detect. In this case, alternatives include performance-based monitoring, inspections, or in the case of closure bolting for components that are not normally pressurized, checking torque to demonstrate that the bolting is not loose. The recommended alternatives can be capable of determining if leakage is occurring.

Comment: 077

XI.M18 Element 4 - Page XI.M18-3, first and third bullets

Revise the questions in Element 4 as indicated in the markup section of this comment.

Basis:

Editorial

Markup

Are there any systems which have had an out-of-spec water chemistry condition for a longer period of time or out-of-spec conditions *which have* occurred more frequently?

For raw water systems, is the water source from different sources where one or the other is more susceptible to microbiologically-induced corrosion or other aging ~~*effects*~~ *mechanisms*?

RESPONSE:

The staff agreed with this comment. The changes were incorporated as requested. The editorial changes do not affect the staff's intent. Specifically, MIC is an aging mechanism, not an aging effect.

Comment: 078

XI.M18 Element 4 - Page XI.M18-3, second to last paragraph

UT examination of non-safety related bolting with unknown yield strength is not necessary.

Basis:

The Bolting Integrity program includes other features which are intended to manage cracking of non-safety related closure bolting regardless of whether the closure bolting is high strength or not. For example, element 3 recommends that non-safety related closure bolting is monitored for leakage. In which case the leakage would be entered into the corrective action program and the condition is corrected. Therefore, UT examination of non-safety related bolting with unknown yield strength is not necessary.

Markup

High strength closure bolting (with actual yield strength greater than or equal to 1,034 MPa [150 ksi] may be subject to SCC. For bolting with yield strength greater than or equal to 1,034 MPa [150 ksi] ~~*and bolting for which yield strength is unknown (regardless of code classification or size of bolting)*~~, volumetric examination in accordance to that of ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, should be performed.

RESPONSE:

The staff did not agree with this comment; however, some changes were incorporated.

GALL-SLR Report AMP XI.M18, "Bolting Integrity," was revised to incorporate the industry's recommendation for potential sources of yield strength data.

The staff has concluded that nonsafety-related closure bolting could impact the performance of a safety related function, as described in 10 CFR 54.4(a)(2). As a result, AMP XI.M18 does not differentiate between safety-related and nonsafety-related closure bolting. The staff has concluded that for high-strength closure bolting it is appropriate to conduct periodic volumetric examinations to inspect for cracking. Cracking, in contrast to loss of material, can propagate rapidly and result in the failure of the bolted joint. Surface cracks can propagate to closure bolting failure. However, leakage would not be evident for surface cracks. Conducting periodic volumetric examinations provides reasonable assurance that cracking is not occurring. AMP XI.M18 was revised to state that sample size and frequency of these inspections is stated in the SLRA. During AMP audits, the staff would validate the appropriateness of the sample size and frequency of inspections based on plant-specific operating experience.

The staff concluded that the industry recommended sources of yield strength data are appropriate because they are all documents controlled or stored by the applicant.

<u>**Comment**: **079**</u>

XI.M18 Element 4–Page XI.M18-3, top paragraph

If the UT examination of non-safety-related bolting with unknown yield strength is considered necessary by the NRC (rejection of comment 3 above), then it is requested the wording be revised to clarify scope (for non-safety-related bolting). If the UT examination of non-safety-related bolting with unknown yield strength is considered necessary by the NRC (rejection of comment 3 above), then it is requested the above wording be revised to clarify scope (for non-safety related bolting). For example:

- Must the <u>actual</u> yield strength (e.g., via a CMTR) be known for non-safety related bolting?
- Is it acceptable to use the specified (e.g., from design and procurement specifications or fabrication and vendor drawings) bolting material or bolt head markings to determine the specified yield strengths for non-safety related bolting?
- Is it acceptable to exclude non-safety related bolting based on materials that are not susceptible to SCC (e.g., Carbon Steel)?
- Is it acceptable to exclude non-safety related bolting with low operating temperatures?

Without further specificity of this nature the above recommendation could result in the unnecessary UT examination on tens of thousands of non-safety related closure bolts.

<u>Basis</u>:

The Bolting Integrity program includes closure bolting from many non-safety related systems. For bolting in this category (e.g., non-safety related closure bolting) the <u>actual</u> yield strength would not have been provided by the manufacturer. As such the actual yield strength of these bolts is unknown. This could be potentially tens of thousands of non-safety related bolts. Therefore, this recommendation could force the UT examination of many pressure retaining bolts on non-safety related systems simply because the actual yield strength of the bolts was not provided by the manufacturer.

Markup

High strength closure bolting (with actual yield strength greater than or equal to 1,034 MPa [150 ksi]) may be subject to SCC. For bolting with *actual* yield strength greater than or equal to 1,034 MPa [150 ksi] and bolting for which yield strength is unknown (regardless of code classification or size of bolting), volumetric examination in accordance to that of ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, should be performed." *Specified bolting materials (e.g., from* design and procurement specifications or fabrication and vendor drawings) *may be used to determine if the bolting is a high strength closure.*

RESPONSE:

The staff partially agreed with this comment.

GALL-SLR Report AMP XI.M18, "Bolting Integrity," was revised to incorporate the industry's recommendation for potential sources of yield strength data. See the response to Comment 016-078 for the basis for this response.

Comment: 080

XI.M18 Element 4–Page XI.M18-3, last paragraph

Remove the sentence, "Non-ASME Code inspections follow site procedures that include inspection parameters for items such as lighting, distance offset, and cleaning processes that ensure an adequate examination."

Basis:

In this program inspection of non-ASME Code bolting consists of system walkdowns which monitor for joint leakage. The deleted words below are overly prescriptive for this activity.

Markup

Inspections are performed by personnel qualified in accordance with site procedures and programs to perform the specified task. Inspections within the scope of the ASME Code follow procedures consistent with the ASME code. ~~*Non-ASME Code inspections follow site procedures that include inspection parameters for items such as lighting, distance offset, and cleaning processes that ensure an adequate examination.*~~

RESPONSE:

The staff partially agreed with this comment.

GALL-SLR Report AMP XI.M18, "Bolting Integrity," was revised to delete the recommendation associated with cleaning processes for inspections. The staff concluded that bolting does not require cleaning to verify that there is no leakage. Lighting and distance offset are basic inspection parameters that should be in place.

Comment: 081

XI.M19 Program Description, Page XI.M19-1 Line 21

Paragraph 4 in the Program Description references a specific revision to NEI 97-06 specifically revision 3. NEI 97-06 may be revised in the future. Delete the specific revision.

Basis:

This precludes any future revisions to any of the industry documents by referencing specific revisions. Industry guidance is revised from time to time to reflect needed changes. We need the capability to revise industry guidelines.

Markup

The Steam Generator program at PWRs is modeled after Nuclear Energy Institute (NEI) 97-06, ~~*Revision 3*~~, “Steam Generator Program Guidelines.” This program references a number of …

RESPONSE:

The staff did not agree with this comment.

The NRC cannot reference documents that do not have a date or revision number. Without a reference to a date or revision number, the staff cannot ensure that all versions will provide adequate technical basis for the aging management practices in this AMP.

Comment: 082

XI.M19 Element 3, Page XI.M19-3 Lines 2-3

Element 3 references a specific version of the EPRI PWR Steam Generator Primary-to-Secondary Leakage Guidelines and the EPRI Steam Generator Integrity Assessment Guidelines by incorporating the document numbers in to the sentence. Delete the document number in the sentence.

Basis:

This precludes any future revisions to any of the industry documents by referencing specific revisions. Industry guidance is revised from time to time to reflect needed changes. We need the capability to revise industry guidelines.

Markup

Water chemistry parameters are also monitored as discussed in GALL-SLR Report AMP XI.M2. The EPRI PWR Steam Generator Primary-to-Secondary Leakage Guidelines ~~*(EPRI 1008219)*~~ provides guidance on monitoring primary-to-secondary leakage. The EPRI Steam Generator Integrity Assessment Guidelines ~~*(EPRI 1019038)*~~ provide guidance on secondary side activities.

Source 016

RESPONSE:

The staff did not agree with this comment.

The NRC cannot reference documents that do not have a date or revision number. Without a reference to a date or revision number, the staff cannot ensure that all versions will provide adequate technical basis for the aging management practices in this AMP.

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Comment: 083

XI.M19 Element 4, Page XI.M19-3 Line 26

Element 4 references a specific version of the EPRI PWR Steam Generator Examination Guidelines by incorporating the document number into the sentence. Delete the document number in the sentence.

Basis:

This precludes any future revisions to any of the industry documents by referencing specific revisions. Industry guidance is revised from time to time to reflect needed changes. We need the capability to revise industry guidelines.

Markup

The inspections and monitoring are performed by qualified personnel using qualified techniques in accordance with approved licensee procedures. The EPRI PWR Steam Generator Examination Guidelines ~~*(EPRI 1013706)*~~ contains guidance on the qualification of steam generator tube inspection techniques.

RESPONSE:

The staff did not agree with this comment.

The NRC cannot reference documents that do not have a date or revision number. Without a reference to a date or revision number, the staff cannot ensure that all versions will provide adequate technical basis for the aging management practices in this AMP.

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Comment: 084

XI.M20 Program Description, Page XI.M20-1

Delete the word “preclude” on line 10 and substitute wording that reflects the NRC GL 89-13 intent, e.g., significantly reduce the incidence of flow blockage as a result of biofouling.

Basis:

NRC Generic Letter 89-13 does not require the preclusion of biofouling on the safety-related components, only the management of the biofouling to ensure the intended function is not impacted adversely. To preclude biofouling might require extensive modifications and significant changes to chemical control operations.

Markup

… (SSCs) to the ultimate heat sink. The program is comprised of the aging management aspects of the applicant's response to NRC GL 89-13 including: (a) a program of surveillance and control techniques to ~~preclude~~ *significantly reduce the incidence of flow blockage as a result of* biofouling; (b) a program to verify heat transfer capabilities of all safety-related heat exchangers cooled by the OCCW system; and (c) a program for routine inspection and maintenance to ensure that corrosion, erosion, loss of coating integrity, fouling, and biofouling cannot degrade the performance of safety-related systems serviced by the OCCW system.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made.

Generic Letter 89-13 Action 1 states: "For open-cycle service water systems, implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling. A program acceptable to the NRC is described in "Recommended Program to Resolve Generic Issue 51" (Enclosure 1). It should be noted that Enclosure 1 is provided as guidance for an acceptable program. An equally effective program to preclude biofouling would also be acceptable. Initial activities should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. All activities should be documented and all relevant documentation should be retained in appropriate plant records." Replacing "preclude" with "significantly reduce the incidence of flow blockage as a result of" is acceptable because it reflects the wording in GL 89-13.

Comment: 085

XI.M20 References

There is no reference to, or inclusion of the significant industry learning and guidance relative to open cooling water systems corrosion and fouling control as documented in EPRI reports 1025318, 1008282, and 1010059.

Basis:

EPRI 1025318, Open Cooling Water Chemistry Guideline, September 2012;

EPRI 1008282, Life Cycle Management Sourcebook for Nuclear Plant Service Water Systems, March 2005; and EPRI 1010059, Service Water Piping Guideline, September 2005 have captured significant industry experience and contain industry standards for controlling system corrosion and fouling. INPO 13-005, Guidelines for the Conduct of Chemistry at Nuclear Power Stations, notes the EPRI guidance available for open cooling water chemistry control. It seems appropriate that the above three (3) EPRI documents should be at least referenced as industry guidance or recommendations that aid in meeting the objectives of GL 89-13 and AMP XI.M20.

RESPONSE:

EPRI 1025318 is not available for the staff's review, and guidance to the staff has been that we cannot endorse documents that we have not reviewed. Based on new guidance to consider the "Reference" section of this document as a "Bibliography" the other two documents (EPRI 1008282 and EPRI 1010059), which the staff has reviewed, were included in the References section as the staff has reviewed the additional documents.

Comment: 086

XI.M21A Program Description–Page XI.M21A-1

Page XI.M21A-1 Lines 19-22 are confusing descriptions of closed cooling water systems, and include one system (aux. boiler system) which is not a cooling system at all.

Basis:

- Auxiliary boiler systems produce steam, and are not cooling water systems. It is inappropriate and confusing to include auxiliary boilers with closed cooling water systems when it would be more appropriate to include them with the secondary water chemistry or BWR chemistry aging management programs.

- The examples of systems managed by this AMP are described as: (a) closed-cycle cooling water systems (as defined by GL 89-13); (b) closed portions of HVAC systems; (c) diesel generator cooling water; and (d) aux. boiler systems. GL 89-13 defines a closed-cycle system is part of a safety-related service water system which, among other things, does not directly reject heat to the ultimate heat sink. Does this mean that (b) and (c) are non-safety-related closed cooling water systems, whereas (a) includes safety-related HVAC systems and diesel cooling water systems? This distinction is important and needs clarification since Page XI.M21A-2 Lines 19-20 state that "For CCCW systems as defined in NRC GL 89-13, EPRI 1007820 is used" and that for all other systems, which would imply all non-safety-related closed cooling water systems, "the applicant selects an appropriate industry standard document".

  Note that the EPRI Closed Cooling Water Chemistry Guideline are applicable to both safety-related and non-safety-related closed cooling water systems, which includes plant-related HVAC systems and diesel generator cooling water systems.

- Does this description include standby or dedicated shutdown diesels since they are skid mounted and reject their heat via radiators directly to the ultimate heat sink which is the atmosphere? Note that the EPRI Closed Cooling Water Chemistry Guideline is also applicable for the diesel cooling water system for these diesels also.

Markup:

…Letter (GL) 89-131); closed portions of heating, ventilation, and air conditioning (HVAC) systems; and diesel generator cooling water~~; *and auxiliary boiler systems.*~~ Examples of systems…

RESPONSE:

The staff agreed with the comment and proposed change.

The water used in systems covered by this AMP may be, but need not be, demineralized and receives chemical treatment, including corrosion inhibitors, unless the systems meet the industry guidance for pure water systems. Otherwise, untreated water systems are addressed using other AMPs, such as AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." Examples of systems managed by this AMP include closed-cycle cooling water (CCCW) systems (as defined by the U.S. Nuclear Regulatory Commission (NRC) Generic Letter (GL) 89-13); closed portions of heating, ventilation, and air conditioning (HVAC) systems; and diesel generator cooling water. Examples of systems not addressed by this AMP include those systems containing boiling water reactor (BWR) coolant, pressurized water reactor (PWR) primary and secondary water, and PWR/BWR condensate that do not contain corrosion inhibitors. Aging in these systems is managed by AMP XI.M2, "Water Chemistry," and the AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." Treated fire water systems, if present, are also not included in this AMP.

NRC GL 89-13 defines a service water system as "the system or systems that transfer heat from safety-related structures, systems, or components to the ultimate heat sink." NRC GL 89-13 further defines a closed-cycle system as a part of the service water system that is not subject to significant sources of contamination, one in which water chemistry is controlled and in which heat is not directly rejected to an ultimate heat sink.

GALL-SLR Report Chapter 1, Table 1, identifies the ASME Code Section XI editions and addenda that are acceptable to use for AMPs

The changes related to examples of "included or not included" systems are a minor clarification.

Comment: **087**

XI.M21A Program Description–Page XI.M21A-1

Insert AMP purpose sentence from Table 3.0-1 into program description on lines 6-7, since the current program description never states the objective of the program. Insert clarifying wording about the systems that are not covered by this aging management program.

Basis:

The program description never states the objectives of the aging management program.

Source 016

Markup

… These systems are also recirculating systems in which the rate of recirculation is much higher than the rate of addition of makeup water (i.e., closed systems). *This Closed Treated Water Systems aging management program is a mitigation program that also includes condition monitoring to verify the effectiveness of the mitigation activities.* The program includes (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)…

Examples of systems not addressed by this AMP include *those systems containing* boiling water reactor (BWR) coolant, pressurized water reactor (PWR) primary and secondary water, and PWR/BWR condensate *that do not contain corrosion inhibitors.* ~~*systems*~~.…

RESPONSE:

The staff agreed with the comment and proposed change as written. Note that the system changes discussed above are shown in the "Recommended Change" for the previous comment.

Nuclear power plants (NPPs) contain many closed, treated water systems. These systems undergo water treatment to control water chemistry and prevent corrosion (i.e., treated water systems). These systems are also recirculating systems in which the rate of recirculation is much higher than the rate of addition of makeup water (i.e., closed systems). This is a mitigation program that also includes condition monitoring to verify the effectiveness of the mitigation activities. The program includes (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 degradation. Depending on the industry standard selected for use in association with this AMP and/or plant operating experience, this program also may include corrosion monitoring (e.g., corrosion coupon testing) and microbiological testing.

The AMP's objective is appropriately captured by the comment.

Comment: 088

XI.M21A Element 3 Page XI.M21A-2

Lines 19-20 state that "For CCCW systems as defined in NRC GL 89-13, EPRI 1007820 is used." The referenced EPRI document is out of date and has been superseded by EPRI 3002000590. The GALL should state that the latest approved EPRI Closed Cooling Water Chemistry Guideline should be used.

Basis:

EPRI 1007820 is Rev. 1 of the Closed Cooling Water Chemistry Guideline that was issued in April 2004. This guideline is out of date and has been superseded by EPRI 3002000590, Closed Cooling Water Chemistry Guideline, Rev. 2, December 2013.

This comment was identified previously in a more generic form in the NEI Industry Comments submitted by letter dated 8/6/14 which identified technical issue SLR-M23 stating that AMPs (e.g., water chemistry AMPs) that reference EPRI reports such as water chemistry guidelines, should allow the use of the latest approved version of the EPRI report. This comment has **not** been incorporated into the GALL document.

Markup

…For CCCW systems, as defined in NRC GL 89-13, ~~*EPRI 1007820 is used*~~ *the latest approved EPRI chemistry document is used for the control of closed cooling water parameters.*

RESPONSE:

The staff did not agree with this comment.

EPRI 1007820 was previously reviewed by the staff; however, the new EPRI document is not available for staff review and guidance to the staff does not endorse documents that the staff has not reviewed (i.e., the latest approved EPRI chemistry document for the closed cooling water parameters). Current staff guidance does not permit us to endorse documents that we have not reviewed.

Comment: 089

XI.M21A Element 3 Page XI.M21A-2

Lines 14-22 lists several references which can be used as industry standard documents for systems which do not meet the GL 89-13 definition of a closed cycle system; however, the industry uses only the EPRI Closed Cooling Water Chemistry Guideline as the industry standard.

Basis:

INPO 13-005, Guidelines for the Conduct of Chemistry at Nuclear Power Stations, October 2013, and the desire to use industry best practices drives the use of the most recently approved revision of the EPRI Closed Cooling Water Chemistry Guideline as the industry standard for safety-related and non-safety-related closed cooling water systems.

Markup

…specific water chemistry parameters monitored and the acceptable range of values for these parameters are in accordance with ~~*industry standard guidance documents*~~ the Closed Cooling Water Chemistry Guideline produced by the Electric Power Research Institute (EPRI), ~~*the American Society of Heating Refrigeration and Air Conditioning Engineers, the Cooling Technology Institute, the American Boiler Manufacturer's Association, American Society for Testing and Materials (ASTM) standards, water chemistry guidelines recommended by the equipment manufacturer, Nalco Water Handbook, or the ASME. For*~~ including CCCW systems, as defined in NRC GL 89-13~~*, EPRI 1007820 is used. For other systems, the applicant selects an appropriate industry standard document.*~~ In all cases, the ~~*selected industry standard guidance document*~~ EPRI Closed Cooling Water Chemistry Guideline is used in its entirety for the water chemistry control or guidance.

Source 016

RESPONSE:

The staff agreed with the comment and the minor changes to the commenter's markup.

Water chemistry parameters (such as the concentration of iron, copper, silica, oxygen, and hardness, alkalinity, specific conductivity, and pH) are monitored because maintenance of optimal water chemistry prevents loss of material and cracking due to corrosion and SCC. The specific water chemistry parameters monitored and the acceptable range of values for these parameters are in accordance with the EPRI "Closed-Cooling Water Chemistry Guideline," which is used in its entirety for the water chemistry control or guidance.

The EPRI "Closed Cooling Water Chemistry Guideline" is acceptable guidance and applicants can take an exception to the AMP if different guidelines are to be used.

Comment: 090

XI.M21A Element 3 Page XI.M21A-2

Lines 23-27 do not appear to be written consistently with Lines 9-22 of Element 3

Basis:

For consistency with the previous paragraph in Element 3 discussing water chemistry monitoring (Lines 9 to 22), consider the following revision.

Markup

~~*The visual appearance of surfaces provides evidence of loss of material. Surface discontinuities revealed by surface or volumetric examination techniques provide evidence of cracking. The heat transfer capability of heat exchanger surfaces is evaluated by either visual inspections to determine surface cleanliness, or functional testing to verify that design heat removal rates are maintained. The condition of surfaces exposed to water is monitored by visual inspection and surface or volumetric examinations for evidence of loss of material and cracking, and for fouling that would impact heat exchanger performance.*~~

The visual appearance of the surfaces is evaluated for evidence of loss of material. The results of surface or volumetric examinations are evaluated for surface discontinuities indicative of cracking. The heat transfer capability of heat exchanger surfaces is evaluated by either visual inspections to determine surface cleanliness, or functional testing to verify that design heat removal rates are maintained.

RESPONSE:

The staff agreed with the comment as written. The change is an editorial clarification.

Comment: 091

XI.M21A Element 4 Page XI.M21A-2

The inspection for this area is predominately pipe. Clarifying language for pipe inspection to susceptible areas for degradation or acceptable sample size should be provided. As the intent is not to inspect the entire length of the piping system, but similar to inspections for FAC.

Basis:

NUREG–2191, Element 4, provides criteria for representative sample sizes of 20% of population, or maximum of 25 components per population at each unit, etc. The definition provided for a component is having the same material, water treatment program and aging effect combination.

RESPONSE:

The staff agreed with the comment and added the sentence from the External Surfaces AMP that clarifies piping inspections. The change is considered an editorial clarification and not a technical change.

Because the control of water chemistry may not be fully effective in mitigating the aging effects, inspections are conducted. Visual inspections of internal surfaces are conducted whenever the system boundary is opened. At a minimum, in each 10-year period during the subsequent period of extended operation, a representative sample of 20 percent of the population (defined as components having the same material, water treatment program, and aging effect combination) or a maximum of 25 components per population at each unit is inspected using techniques capable of detecting loss of material, cracking, and fouling, as appropriate. The 20 percent minimum is surface area inspected unless the component is measured in linear feet, such as piping. In that case, any combination of 1-foot length sections and components can be used to meet the recommended extent of 25 inspections. Technical justification for an alternative sampling methodology is included in the program's documentation. For multi-unit sites where the sample size is not based on the percentage of the population, it is acceptable to reduce the total number of inspections at the site as follows. For 2-unit sites, 19 components are inspected per unit and for a 3-unit site, 17 components are inspected per unit. In order to conduct 17 or 19 inspections at a unit in lieu of 25, the SLRA includes the basis for why the operating conditions at each unit are sufficiently similar (e.g., flowrate, chemistry, temperature, excursions) to provide representative inspection results.

Source 017: NEI Attachment 4—Mechanical AMPs XI.M23—XI.M42

Comment: 001

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

GALL-SLR Element 7, All AMPs

Comment 1, All AMPs–Element 7

Remove the requirement that results that do not meet the acceptance criteria are addressed as conditions adverse to quality or significant conditions adverse to quality. Just specify that results not meeting acceptance criteria are entered into the site's Corrective Action Program and addressed as required by the program.

- Site Corrective Action Programs are well established programs that are audited by the industry and inspected by the NRC on a regular basis. The program includes provisions for entering a wide variety of conditions into the program and evaluating those conditions to determine appropriate corrective actions. That evaluation includes determining which conditions should be labeled as "conditions adverse to quality" or "significant conditions adverse to quality." When items are identified by the NRC that were not addressed appropriately, violations are given. Every failure to meet AMP acceptance criteria does not rise to the level of being a condition adverse to quality. That requirement would result in cumulative effects that could overwhelm the program and make it ineffective.

- Markup: Results that do not meet the acceptance criteria are ~~addressed as conditions adverse to quality or significant conditions adverse to quality under those specific portions of the quality assurance (QA) program~~ entered into the site's Corrective Action Program that ~~are~~ is used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B to ensure appropriate corrective actions are taken in accordance with that program.

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested.

The terms "condition adverse to quality" (CAQ) and "significant condition adverse to quality" (SCAQ) were used by the staff because they represent the two terms used in 10 CFR 50 Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Facilities," Criterion XVI, "Corrective Actions." However, the staff recognizes that the industry's use of corrective action programs has significantly evolved since the initiation of Criterion XVI. Corrective action programs are now used to document an extensive scope of issues including conditions other than a CAQ or SCAQ. A component might be identified as not meeting the acceptance criteria; however, the observed degradation might not be such that the intended function of the component is affected or would be affected throughout the subsequent period of extended operation. As a result, elevation to a CAQ or SCAQ is not appropriate.

An example follows. The Acceptance Criteria program element for GALL-SLR Report Aging Management Program (AMP) XI.M41, "Buried and Underground Piping and Tanks," states in part that, "[b]ackfill is acceptable if the inspections do not reveal evidence that the backfill caused damage to the component's coatings or the surface of the component (if not coated)." During an excavated buried pipe inspection, the licensee notes that there is very minor damage to the protective coatings associated with a segment of buried steel piping. It is determined that the damage occurred because a cinder block had been left in the backfill during construction. A coating specialist evaluates the degree of damage to the coating and concludes that it was insufficient to challenge the coating's integrity throughout the subsequent period of extended operation (e.g., only one layer of the wrap had damage). This condition does not meet the acceptance criteria because there is evidence that the backfill caused damage to the component's coatings. As a result, a corrective action entry is initiated. In this example, the licensee might classify the condition as a CAQ and repair the coating. Alternatively, repairing the coating might not be a good idea because removing the wrap and installing a new wrap could result in further degradation to the coating at the new overlap joint. If this is the case, in lieu of classifying the condition as a CAQ, the licensee could enter the condition into its corrective action program as a "track and trend" issue.

The staff believes that it is appropriate to set challenging acceptance criteria in the AMPs so that tracking and trending occurs at a low level in the corrective action process. However, in light of this, the determination of whether a degraded condition is classified as a CAQ or SCAQ should be based on a case-by-case basis by the licensee's staff qualified to make such determinations.

Comment: 002

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M23-1, line 24, Element 1(c)

Delete SCC phrase from part (c).

- SCC is not an aging mechanism for bolting associated with cranes and hoists. The bolting material is almost exclusively carbon steel; not stainless steel that is much more susceptible to SCC. The vast majority of cranes and hoists are in Air-Indoor Uncontrolled environment that doesn't result in possibility of aggressive environment or high temperatures that increase susceptibility to SCC. The visual monitoring that is in place is intended to identify cracking if it exists. There is no need to call out SCC as an aging mechanism in the AMP since cracking by any mechanism is inspected for within the periodic inspection required by the ASME B30 Standards.
- Markup: […] in the rail system, and (c) cracking ~~*due to SCC*~~ of high strength bolts.

RESPONSE:

The staff partially agreed with this comment.

Reference to "SCC of high strength bolts" was removed from GALL-SLR Report AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems;" however, cracking of bolting was not removed.

American Society of Mechanical Engineers (ASME) B30.2-2011, Section 2-2.1.5, "Periodic Inspection," item 1, includes inspections for cracked members. Although not specifically cited for bolts and nuts, the list of items to be inspected for cracking in item 4 is modified with the term "such as." As recommended by the industry and based on its review of ASME B30.2, the staff concluded that visual inspections for cracks in bolting should be conducted at the same time as for structural members. The staff did not agree with the industry's statement that the air-indoor uncontrolled environment does not create an aggressive environment. Flange or packing leakage in the vicinity of a crane could potentially transport halogens that would promote cracking in high strength bolting or stainless-steel bolting. In making this statement, the staff is not implying that an applicant should determine the bolting material type or material properties in order to inform the inspections of crane bolting. As stated above, the visual inspections for cracking in crane bolting can occur coincident with the inspection for all cited aging effects of all crane members.

Comment: 003

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M23-1, lines 30-33, Element 3

Revise Element 3 regarding special monitoring of high strength bolts.

- This new statement about special monitoring of high strength bolts is not needed. The referenced AMSE B30 series of standards includes periodic visual inspection of bolting, regardless of material, size, or yield strength. The visual inspections performed under ASME B30 standards are intended to identify any degradation of the bolting components regardless of bolting size. Therefore, the statement should be deleted and cracking should be added to the prior sentence.

- Mark-up: Surface condition is monitored by visual inspection to ensure that loss of material is not occurring due to corrosion or wear. Bolted connections are monitored for loose bolts, missing or loose nuts, and other conditions indicative of loss of preload, and cracking. ~~*High strength (actual measured yield strength greater than 150 kilopounds per square inch (ksi) or 1034 kilopascals (MPa)) bolts greater than 1 inch in diameter are monitored for SCC.*~~

RESPONSE:

The staff agreed with this comment. References to high-strength bolting material were removed from GALL-SLR Report AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems." As stated in the response to Comment 017-002, the visual inspections for cracking in crane bolting can occur coincident with the inspection for all cited aging effects of all crane members. The inspections do not need to be informed of the potential presence of high-strength crane bolting.

Comment: 004

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

Source 017

XI.M23-1, lines 40-43, & M23-2, lines 1-2, Element 4

Unnecessary NDE requirements added for structural bolting for cranes in this scope. This new requirement to do NDE beyond visual inspection is excessive and not required.

- The standard for crane maintenance and inspection, throughout all industries where cranes are used, is the ASME B30 series of standards. In many of these crane applications the cranes are in severe outdoor environments and used under more frequent and severe service than cranes used in the nuclear power industry where the vast majority of in scope cranes are in controlled indoor environments and used to support infrequent maintenance activities.

- The ASME B30 standards for periodic inspection only require visual inspection of bolting to identify aging effects including loosening, corrosion, and cracking and have been proven to be adequate within the nuclear power industry and other industries where cranes are under heavier duty with more continuous service.

- There is nothing special or different about the bolting used on cranes at nuclear power plants that warrant requiring additional periodic NDE examination of high strength bolting. The most likely causes of cracking of structural bolts on crane systems are fatigue or excessive forces caused by the bolt becoming loose.

- Bridge cranes such as Refueling Cranes are evaluated as part of License Renewal for fatigue to verify that their lifetime usage, extending through the SLR PEO will be within the crane design, and the periodic visual examination of bolting has been effective to identify loose bolts as intended by the periodic visual inspections required by the ASME B30 Standards.

- The periodic visual inspections are performed frequently; every 2 years for frequently used cranes or just prior to use for infrequently used cranes. Therefore, the periodic visual inspection of bolting required by ASME B30 standards is adequate to identify cracked or loose bolts prior to loss of function.

- Mark-up: […] Bolted connections are visually inspected for loose bolts or missing nuts at the same frequency as crane rails and structural components. Visual inspection of high strength (actual measured yield strength greater than 150 kilopounds per square inch (ksi) or 1034 kilopascals (MPa) structural bolting greater than 1 in. (25 mm) in diameter is supplemented with volumetric or surface examinations to detect cracking at an interval not to exceed 5 years, unless justified.

RESPONSE:

The staff agreed with this comment. References to volumetric and surface examination of crane bolting were removed. Based on the staff's review of ASME B30.2, an industry consensus standards document, visual inspections are appropriate to detect aging effects for all crane members including bolting. The staff has not identified any operating experience (OE) that would result in a need to augment the inspections cited in the ASME standards during the subsequent period of extended operation.

Comment: 005

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M23-2, lines 9-10, Element 6

In element 6, the statement for volumetric or surface examinations should be deleted.

- The same reasoning applies as described in the Bases for recommended changes to Elements 1, 3, and 4 above.

- Mark-up: Any visual indication of loss of material due to corrosion or wear and any visual sign of loss of bolting preload is evaluated according to ASME B30.2 or other applicable industry standard in the ASME B30 series. ~~*Volumetric or surface examinations confirm the absence of cracking in high strength bolts.*~~

RESPONSE:

See the previous response to Comment 017-004.

Comment: 006

XI.M24-1, Program Description and applicable program elements

Recommend revising the Compressed Air Monitoring AMP to be applicable to the air/gas environment downstream of the compressed air system dryers that can be evaluated as a dry air environment. The AMP scope would confirm the air dryers maintain moisture and other corrosive contaminants in the system's air below specified limits to ensure that the system and components maintain their intended functions. If components upstream of the compressed air system dryers are within the scope of license renewal, their internal air environment would be evaluated as a plant indoor air or condensation environment and would be managed by AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components. The following considerations would apply to revision of the applicable program elements.

- See program description markup

- The scope of the AMP manages the dry gas portions of the compressed air system downstream of the Compressed air system dryers. The internal environment is considered as a dry gas environment.

- Compressed air system components upstream of the compressed air dryers are evaluated as a plant indoor air or condensation environment and would be managed by AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.

- Use of XI.M24 does not change the docketed response to GL 88-14 for the rest of the plant operations.

- Compressed air system gas quality is managed consistent with the docketed response to GL 88-14. Acceptance criteria for air quality and moisture limits are established based on industry standards.
- Opportunistic inspections of the internal surfaces environment downstream of the compressed air system(s) dryers is performed to verify the system-wide effectiveness of the air quality controls of the Compressed Air Monitoring AMP. The opportunistic inspections would confirm that unacceptable degradation is not occurring downstream of the dryers and ensure the intended functions of affected components are maintained during the period of extended operation
- Revision of the gas environment in GALL-SLR Chapter IX is covered by a prior comment.

<u>XI.M29 Markup</u>

Program Description

The purpose of the compressed air monitoring program is to provide reasonable assurance of the integrity of the compressed air system. The program consists of monitoring moisture content, corrosion, and performance of the compressed air system <u>downstream of the air dryers</u>. This includes (a) preventive monitoring of water (moisture) and other potential contaminants to keep within the specified limits; and (b) <u>an opportunistic </u>inspection <u>of the internal surfaces of</u> components ~~*for indications of loss of material due to corrosion*~~ <u>downstream of the air dryers to verify the effectiveness of the compressed air system air quality controls</u>.

~~*The compressed air monitoring aging management program (AMP) is based on results of the plant owner's response to the U.S. Nuclear Regulatory Commission (NRC) Generic Letter (GL) 88-14 (as applicable to license renewal) and reported in previous NRC Information Notice (IN) 81-38; IN 87-28; IN 87-28, Supplement 1; and by the Institute of Nuclear Power Operations (INPO) Significant Operating Experience Report (SOER) 88-01. NRC GL 88-14, issued after several years of study of problems and failures of instrument air systems, recommends that each holder of an operating license perform an extensive design and operations review and verification of its instrument air system.*~~ NRC GL 88-14 also recommends that the licensees describe their program for maintaining proper instrument air quality. This AMP does not include all aspects of NRC GL 88-14 because many of the issues in the GL are not relevant to license renewal.

This AMP does not change the applicant's docketed response to NRC GL 88-14 for the rest of its operations. ~~*The program utilizes the aging management aspects of the applicant's response to NRC GL 88-14 for license renewal with regard to preventative measures, inspections of components, and testing and to ensure that the compressed air system will be able to perform its intended function for the period of extended operation.*~~ The AMP also incorporates the air quality provisions provided in the guidance of the Electric Power Research Institute (EPRI) TR 108147. ~~*The American Society of Mechanical Engineers (ASME) operations and maintenance standards and guides (ASME OM-2012, Division 2, Part 28) provides additional guidance for maintenance of the instrument air system by offering recommended test methods, test intervals, parameters to be measured and evaluated, acceptance criteria, corrective actions, and records requirements.*~~

Compressed air system components upstream of the compressed air dryers are managed by AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.

RESPONSE:

The staff partially agreed with this comment.

GALL-SLR Report AMP XI.M24, “Compressed Air Monitoring,” was revised to be applicable to components downstream of the instrument air dryers. GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” was cited to manage aging effects associated with components upstream of the air dryers. The changes were incorporated in substance as requested; however, changes were made by the staff.

The purpose of GALL-SLR Report AMP XI.M24 is to manage aging effects that could impact the intended function of in-scope instrument air components. GALL-SLR Report AMP XI.M24 is principally a prevention program in that, the preventive action controls to monitor for moisture content and other corrosive contaminants, if successfully implemented, will prevent loss of material in the materials used in instrument air systems (e.g., steel, stainless steel, copper alloy, aluminum alloy). The staff has modified the scope of the program to include only those components downstream of the compressed air system air dryers, or for components exposed to an internal gas environment (e.g., nitrogen-filled accumulators). The downstream components are confirmed to be exposed to dry air by the preventive actions of this program.

The preventive actions associated with controlling the air in the instrument air system are not applied to components outside the scope of the program (e.g., upstream of the dryers). As a result, the appropriate program to manage aging effects associated with the internal surfaces of these components is AMP XI.M38.

The comment recommended that the dry air downstream of the compressed air system air dryers be incorporated into the term “gas” as used in GALL-SLR Report Chapter IX.D, “Use of Terms for Environments.” The staff concluded that incorporating the environment associated with the dry air downstream of the air dryers into the term “gas” could result in confusion in relation to backup accumulators that are filled with gas (e.g., nitrogen). The term “gas” was modified to delete the term “dry air,” and the term “air-dry” was revised to specifically cite the environment downstream of air dryers.

Given the improved environmental conditions inside compressed air systems downstream of dryers since the issuance of Institute of Nuclear Power Operations (INPO) Significant Operating Experience Report 88-01, “Instrument Air System Failures,” and U.S. Nuclear Regulatory Commission (NRC) Generic Letter (GL) 88-14, “Instrument Air Supply Problems Affecting Safety-Related Components,” the staff concluded that opportunistic inspections in lieu of periodic inspections of the internal surfaces of components within the scope of this program are sufficient. The basis for this conclusion is that the typical materials used in these systems (e.g., steel, stainless steel, copper alloy, aluminum) have no aging effects when exposed to dry air. The GALL-SLR Report already states that there are no aging effects requiring management for these materials exposed to a dry air environment. However, given that AMP XI.M24 preventive actions may not always be met (i.e., while waiting for maintenance actions to improve the performance of dryers or filters), opportunistic inspections are used to confirm that aging effects are not occurring. GALL-SLR Report aging management review (AMR) item A-764, metallic piping and piping components exposed to dry air cites AMP XI.M24 to manage loss of material. Other items, such as E-29, would be used to manage aging effects associated with components upstream of the air dryers, exposed to an air environment. Item E-29 cites AMP XI.M38.

Source 017

Comment: 007

XI.M26-1, Program Description line 5, and Element 3, XI.M26-2 line 6.

Suggest changing the language from “housings” to “assemblies” as this will capture the housing as well as the entire system.

- Mark-up (Program Description): The fire barrier inspection program requires periodic visual inspection of fire barrier penetration seals; fire barrier walls, ceilings, and floors; fire damper assemblies~~*housings*~~; and…
- This comment is also reflected in the mark-up for Element 3 below.

RESPONSE:

The staff agreed with this comment. The term “fire barrier housing” was replaced with “fire barrier assembly.” Changing the term to “fire barrier assembly” will result in including the entire component; whereas, the term “fire barrier housing” could have been interpreted as being only a portion of the component.

Comment: 008

XI.M26, Element 3 lines 4-7, and 4, lines 16-20.

Inspections should also include structural steel fire proofing.

- Mark-up (Element 3): Visual inspection of penetration seals examines the surface condition of the seals for any sign of degradation. Visual inspection of the surface condition of the fire barrier walls, ceilings, and floors and other fire barrier materials detects any sign of degradation including structural steel fire proofing. Fire damper assemblies ~~*housings*~~ are inspected for signs of corrosion and cracking. Fire-rated doors are visually inspected to detect any degradation of door surfaces.
- Mark-up (Element 4): Visual inspection by fire protection qualified personnel of the fire barrier walls, ceilings, floors, and doors; fire damper housings; and other fire barrier materials including structural steel fire proofing performed in walkdowns at a frequency in accordance with an NRC-approved fire protection program ensure timely detection of cracking, spalling, and loss of material.

RESPONSE:

The staff agreed with this comment.

Structural steel fire proofing material was added to the Parameters Monitored or Inspected and Detection of Aging Effects program elements.

The staff agreed that inspections should also include structural steel fire proofing. Spray-on fire proofing material had been cited in the Scope of Program program element; however, adding it to the other program elements provides recommendations in relation to the type of inspection (visual) and periodicity of inspections (in accordance with an NRC-approved fire protection program).

Comment: 009

XI.M26-1 and several similar locations (see below)

Recommend to include clean agents in various texts as shown below, in addition to halon/CO_2.

- Plants may have phased out halon systems and replaced them with clean agent systems. The document should reflect the other types of gaseous system that may be used.

XI.M26, Section 2, Program Description, Line 7 and 8

- (Mark-up): The AMP also includes periodic inspection and testing of the halon/carbon dioxide (CO_2), <u>or clean agent</u> fire suppression system.

XI.M26 Section 2 Program Description Line 39 and 40

- (Mark-up): It also manages the aging effects on the intended function of the halon/CO_2, <u>or clean agent</u> suppression system.

XI.M26 Section 3 Parameters Monitored or Inspection Line 9 and 10

- (Mark-up): The periodic visual inspections of the surface condition for the halon/CO_2, <u>or clean agent</u> fire suppression system are performed.

XI.M26 Section 4 Detection of Aging Effects Line 24 and 25

- (Mark-up): Visual inspections of the halon/$CO_{2,}$ <u>or clean agent</u> fire suppression system are performed to detect any sign of corrosion before the loss of the component intended function.

XI.M26 Section 6 Acceptance Criteria Line 38-40

- (Mark-up): Also, inspection results for the halon/CO_2, <u>or clean agent</u> fire suppression

RESPONSE:

The staff agreed with this comment.

Clean agent fire suppression systems were added to the Scope of Program, the Program Description, the Parameters Monitored, the Detection of Aging Effects, and the Acceptance Criteria program elements. The staff agreed that the AMP should reflect the other types of gaseous systems that may be used because plants may have phased out halon systems and replaced them with clean agent systems.

Comment: 010

XI.M27–4 Table XI.M27-1 footnote 5, Inspection frequency for inaccessible areas

Inspections described in NFPA-25 as “annual” should be described in this AMP as “every refueling cycle” based on based on LRAs that have taken exception to the annual requirement.

Source 017

Recommend revising footnote 5 of Table XI.M27-1 to allow a refueling frequency rather than annual for NFPA 25 inspections.

- Footnote 5 of Table XI.M27-1 allows Items in areas that are inaccessible because of safety considerations such as those raised by continuous process operations, radiological dose, or energized electrical equipment to be inspected during each scheduled shutdown but not more often than every refueling outage interval.

  Revise footnote #5 Not all nuclear sites are licensed to NFPA 25, 2011 Edition.

- The revised AMP references guidance in NFPA 25, 2011 Edition, which not all plants are licensed to, and will require code compliance reviews against site procedures for those plants.

- The NFPA 25 requirements, including those identified in Table XI.M27-1, Inspection and Testing Recommendations, are overly stringent and the systems are not designed for the frequency of the inspections, which will result in deviation requests.

RESPONSE:

The staff partially agreed with this comment. Footnote 10 was added as described below.

National Fire Protection Association (NFPA) 25 was written for a broad range of facilities, including those with a limited number of fire water system components (e.g., a small manufacturing facility with only a dozen sprinklers) and those with numerous sprinklers (as is typical for power plants). The staff has approved exceptions for the interval of sprinkler inspections for virtually all of the applicant's programs that have been reviewed since the issuance of LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation." The staff based its acceptance on: (a) a sufficient number of sprinklers installed in commercial nuclear power plants to establish an adverse performance trend and (b) plant-specific OE that demonstrates that no loss of intended function has occurred due to the longer interval between inspections. The same basis applies for many of the tests and inspections recommended to be conducted in AMP XI.M27, "Fire Water System." As a result, the staff revised the applicable Table XI.M27-1 tests or inspections that are recommended to be conducted annually to add a footnote that states that the tests or inspections can be conducted on a refueling outage interval if plant-specific OE has shown no loss of intended function of the in-scope systems, structures, and components (SSC).

In regard to nuclear sites, not all are licensed to NFPA 25 2011 Edition. Footnote 1 clearly states that NFPA 25 is only referenced to provide a description of the scope and periodicity of specific inspections and tests. It is not expected that an applicant would conduct a "code compliance review" beyond ensuring that the specific cited tests and inspections are conducted in a like manner to that described in NFPA 25 and GALL-SLR Report AMP XI.M27.

The comment also states, "[t]he NFPA 25 requirements, including those identified in Table XI.M27-1, Inspection and Testing Recommendations, are overly stringent and the systems are not designed for the frequency of the inspections, which will result in deviation requests." The staff reviewed all of the tests and inspections in NFPA 25 and cited those that provide insights into the potential for loss of material and potential flow blockage. Applicants consistently submit exceptions to portions of the GALL-SLR Report AMPs that are not practical due to plant-specific configurations. The staff evaluates these exceptions to determine whether reasonable assurance exists that the impacted components will perform their intended function.

Comment: 011

XI.M27-5, Lines 11-12, Element 6–Acceptance Criteria Item c) of Element 6 states "no fouling exists" which is overly stringent.

- Justification: This requirement for "no fouling" is overly stringent and impossible to meet unless all piping is replaced approximately every 5 years. The acceptance criteria provided in 6.a) "the water-based fire protection system is able to maintain required pressure and flow rates" should be adequate and 6.c) should be deleted.

- Mark-up: The acceptance criteria are: (a) the water-based fire protection system is able to maintain required pressure and flow rates, <u>and</u> (b) minimum design wall thickness is maintained, ~~*and (c) no fouling exists in the sprinkler systems that could cause corrosion or flow blockage in the sprinklers.*~~

RESPONSE:

The staff partially agreed with this comment.

The acceptance criteria was revised to state that, "no loose fouling products exists in systems that could cause flow blockage in the sprinklers or deluge nozzles."

It is likely that there will be many fixed deposits in fire water systems after years of service. This is particularly the case with fire water systems that use raw water versus treated water. Although fixed deposits create additional pressure drops, condition monitoring tests (e.g., underground and exposed piping flow tests, main drain tests) are capable of trending performance in this regard. Loose deposits are a concern because of their potential to clog small openings (e.g., sprinkler heads, nozzles). Evidence of loose particles in the system should be corrected. See NRC Information Notice (IN) 2013-06, "Corrosion in Fire Protection Piping Due to Air and Water Interaction" (ADAMS Accession No. ML13031A618). The staff revised the recommendation accordingly.

Comment: 012

XI.M27-5, Lines 21-23, Element 7–Corrective Actions

The Element states "if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material is removed and its source is determined and corrected." This is overly restrictive and burdensome.

- Justification: Most piping systems for fire water systems are carbon steel and use lake/river water for the water source. This piping fouls and will contain organic material that occurs on the inside of the piping due to the nature of the organics in lake/river water. This requirement will necessitate significant cleaning of the piping systems on a regular basis, the potential addition of a chemical treatment system, and/or replacement of the piping.

- This is overly stringent since flow testing should be adequate to ensure functionality/operability and corrective actions to clean the piping performed once flow testing results indicate a degradation in pipe flow characteristics prior to a flow test failure occurring.

- Mark-up: […] If the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material is removed and ~~*its source is determined and corrected*~~ <u>the inspection results are entered into the site's Corrective Action Program for further evaluation</u>.

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested.

It is appropriate for the AMP to include a recommendation that these deposits be removed. However, as described in the comment, often times the source of the organic material is a lake or river water. It is not practical to "correct" the source of the organic material. In the case of inorganic materials, as described in IN 2013-06, the industry has experienced complete flow blockage of fire water sprinkler systems due to the buildup of loose corrosion products. In the examples cited in IN 2013-05, the cause of the flow blockage was inadequate drainage of normally-dry piping that had been wetted, leading to accelerated corrosion and significant buildup of corrosion products. This aspect of flow blockage is addressed in the inspections recommended in the Detection of Aging Effects program element related to normally-dry periodically wetted piping. As a result, the staff agreed with the industry's comment that the foreign organic or inorganic material sufficient to obstruct pipe or sprinklers is removed and the inspection results are entered into the site's Corrective Action program. The staff has concluded that a site's Corrective Action program can be used to address conditions that do not meet acceptance criteria. See SRP-SLR Section A.1.2.3.7, "Corrective Actions."

<u>**Comment**: **013**</u>

XI.M29–1, Program Description and Element 1

Revise the Program Description and Element 1 to clarify that the scope of tanks includes only <u>metallic</u> tanks. That change will provide clarification and consistency with the statement in Element 3 that describes inspections of metallic tanks.

- The second sentence of the Program Description states that "all outdoor tanks (except fire water storage tanks) and certain indoor tanks are included".

- The first sentence in Element 1 states that "Tanks within the scope of this program include all outdoor tanks except the fire water storage tank, constructed on soil or concrete. Indoor large volume storage tanks…"

RESPONSE:

The staff agreed with this comment.

The change was incorporated as requested. The proposed change is consistent with the staff's intent for the scope of GALL-SLR AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage

Tanks." In addition, the staff reviewed all AMR items associated with AMP XI.M29 and confirmed that all of the cited materials are metallic.

<u>Comment</u>: <u>014</u>

XI.M29–2, Element 4

Change the placement of Table XI.M29-1 so that it is the final information included in Element 4.

- Relevant information that should precede Table XI.M29-1 does not appear until after the table.
- For example, footnote #9 in Table XI.M29-1 mentions "Alternatives to Removing Insulation", which is text that should be placed prior to the table but currently follows the table.

RESPONSE:

The staff agreed with this comment.

The change was incorporated as requested. The editorial rearrangement of Table XI.M29-1 enables a more effective flow of recommendations in the Detection of Aging Effects program element.

<u>Comment</u>: <u>015</u>

XI.M29–3 Element 4

Change the word "piping" to "tanks" in the description of *Alternatives to Removing Insulation* (Item b).

- This appears to be a typographical error since the subject of the AMP is aboveground metallic tanks, not piping.

RESPONSE:

The staff agreed with this comment.

The change was incorporated as requested. The term "piping" should have been "tanks."

<u>Comment</u>: <u>016</u>

XI.M29–4, Table XI.M29-1, *Tank Inspection Recommendations*, Element 4 ():

In Table XI.M29-1, footnote #11, for performing surface examinations to detect cracking, requires inspection of "either 25 sections of the tank's surface (e.g., 1-square-foot sections) or 20 percent of the tank's surface".

Footnote #7, for volumetric inspections to detect loss of material, requires that "at least 25 percent of the tank's internal surface is to be inspected".

- Since surface examinations and volumetric examinations both are valid NDE techniques, the extent of inspections should be consistent.

- Footnote #7 should be revised to require "at least 20 percent of the tank's internal surface is to be inspected".

RESPONSE:

The staff agreed with this comment.

The change was incorporated as requested. An inspection encompassing 20 percent of a population has consistently been used in many AMPs (e.g., XI.M32, "One-Time Inspection," and XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components") as well as GALL-SLR Report AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks."

Comment: **017**

XI.M30-1, Program Description

Change lines 18 and 21, from "is to be" or "is" to "should be"

- The AMP language carries the impression that it is a requirement, whereas the GALL-SLR is a set of recommendations.

RESPONSE:

The staff agreed with this comment. The text was revised to state, "[a]ccordingly, the effectiveness of the program is verified to provide..."

The staff agreed that the GALL-SLR Report is a set of recommendations. However, it is not necessary for every recommendation in an AMP to be prefaced with "should be." To maintain consistency with GALL-SLR Report AMP XI.M30, "Fuel Oil Chemistry," the program would include a means to verify the effectiveness of the chemistry controls. An applicant may state an exception to this recommendation and provide a justification in the application for the exception.

Comment: **018**

XI 01-32 (GALL-SLR, Table XI-01), FSAR Description of M30, page XI 01-32.

The summary has not been updated to agree with the AMP itself.

- Statement changes are needed to bring the FSAR summary into agreement with the program description in XI.M30.

- This same comment applies to SRP-SLR page 3.0-35, Table 3.0-1, for XI.M30.

- Change: "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"…

To

- “Fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the plant’s technical specifications. Guidelines of the American Society for Testing and Materials (ASTM) Standards, such as ASTM D 0975, D 1796, D 2276, D 2709, D 6217, and D 4057, also may be used”.

RESPONSE:

The staff agreed with this comment. The language in the Final Safety Analysis Report (FSAR) should match the language in the AMP.

<u>Comment</u>: **<u>019</u>**

XI.M30-1, Lines 5-8 Program Description.

Delete reference year identifiers in the ASTM Standard numbers mentioned in the section.

<u>Basis</u>:

The years on the ASTM Standards should not be included for this guidance document, as they are different for most of the stations in the industry, and are updated frequently. Some of the ASTM documents identified are approximately 20 years old and have already been revised to more current and up to date methods. The NRC Reg Guide 1.137, Rev 2, “FUEL OIL SYSTEMS FOR EMERGENCY POWER SUPPLIES,” uses the updated (current) ASTM methods for reference. In addition, the FSAR Summary Table XI-01, page XI 01-32, for XI.M30, observes this non-year designator convention.

<u>Markup</u>:

Fuel oil quality is maintained by monitoring and controlling fuel oil 6 contamination in accordance with the plant’s technical specifications (TSs). Guidelines of the American Society for Testing and Materials (ASTM) Standards, such as ASTM D 0975~~*-04*~~, D 1796~~*-97*~~, D 2276~~*-00*~~, D 2709~~*-96*~~, D 6217~~*-98*~~, and D 4057~~*-95*~~, also may be used. Exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by periodic draining or cleaning of tanks and by verifying the quality of new oil before its introduction into the storage tanks.

RESPONSE:

The staff did not agree with this comment.

The NRC cannot reference documents that do not have a date or revision number. Without a reference to a date or revision number, the staff cannot ensure that all versions will provide adequate technical basis for the aging management practices in this AMP.

<u>Comment</u>: **<u>020</u>**

XI.M30-2, Lines 36-38 Element 6, Acceptance Criteria.

Delete reference year identifiers in the ASTM Standards mentioned in the section.

Source 017

Basis:

The years on the ASTM Standards should not be included for this guidance document, as they are different for most of the stations in the industry, and are updated frequently. Some of the ASTM documents identified are approximately 20 years old and have already been revised to more current and up to date methods. The NRC Reg Guide 1.137, Rev 2, “FUEL OIL SYSTEMS FOR EMERGENCY POWER SUPPLIES,” uses the updated (current) ASTM methods for reference.

Markup:

Acceptance criteria for fuel oil quality parameters are as invoked or referenced in a plant’s TSs. […] ASTM D 0975~~*-04*~~ or other appropriate standards may be used to develop fuel oil quality acceptance criteria. Suspended water concentrations are in accordance with the applicable fuel oil quality specifications.

RESPONSE:

The staff did not agree with this comment.

The NRC cannot reference documents that do not have a date or revision number in accordance with the Office of General Counsel guidance. Without a reference to a date or revision number, the staff cannot ensure an adequate technical basis for the aging management guidance in this AMP.

Comment: 021

XI.M30-3 &-4, XI.M30 References Section.

Delete reference year identifiers in the ASTM Standards.

Basis:

The years on the ASTM Standards should not be included for this guidance document, as they are different for most of the stations in the industry, and are updated frequently. Some of the ASTM documents identified are approx. 20 years old and have already been revised to more current and up to date methods. The NRC Reg Guide 1.137, Rev 2, “FUEL OIL SYSTEMS FOR EMERGENCY POWER SUPPLIES,” uses the updated (current) ASTM methods for reference.

Markup:

See references as follows.

- 10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants.” Washington, DC: U.S. Nuclear Regulatory Commission. 2015.

- API. API 653, “Tank Inspection, Repair, Alteration, and Reconstruction.” Washington, DC: American Petroleum Institute. April 2009.

- ASTM. ASTM D 0975~~*-04*~~, “Standard Specification for Diesel Fuel Oils.” West Conshohocken, Pennsylvania: American Society for Testing Materials. ~~*2004*~~.

- _____. ASTM D 4057~~-95~~, "Standard Practice for Manual Sampling of Petroleum and Petroleum Products." West Conshohocken, Pennsylvania: American Society for Testing Materials. ~~2000~~.

- _____. ASTM D 2276~~-00~~, "Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling." West Conshohocken, Pennsylvania: American Society for Testing Materials. ~~2000~~.

- _____. ASTM D 6217~~-98~~, "Standard Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration." West Conshohocken, Pennsylvania: American Society for Testing Materials. ~~1998~~.

- _____. ASTM D 1796~~-97~~, "Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method." West Conshohocken, Pennsylvania: American Society for Testing Materials. ~~1997~~.

- _____. ASTM D 2709~~-96~~, "Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge." West Conshohocken, Pennsylvania: American Society for Testing Materials. ~~1996~~.

RESPONSE:

The staff did not agree with this comment.

The NRC cannot reference documents that do not have a date or revision number. Without a reference to a date or revision number, the staff cannot ensure that all versions will provide adequate technical basis for the aging management practices in this AMP.

<u>Comment</u>: <u>022</u>

XI.M32-2, Element 1, Scope of program, lines 21-25.

Some aspects of this AMP are confusing and seemingly incorrect. (<u>Note</u> that a similar change should be made in XI.M32 entries in GALL Table XI.01 and SRP Table 3.0-1.)

- The statement in Element 1 that "Long-term loss of material due to general corrosion for steel components need not be managed if two conditions are met: (i) the environment for the steel components includes corrosion inhibitors as a preventive action; and (ii) periodic wall thickness measurements on a representative sample of each environment have been conducted every 5 years up to at least the 50th year of operation" is not required since by definition, the long-term loss of material does not involve environments where corrosion inhibitors are used.

- Additionally, the use of corrosion inhibitors and the performance of periodic inspections **<u>is</u>** aging management so the statement "Long-term loss of material due to general corrosion for steel components need not be managed if two conditions are met…" is not correct.

- The statement "periodic wall thickness measurements on a representative sample of each environment have been conducted every 5 years up to at least the 50th year of operation" is confusing. What GALL AMP is performing these periodic inspections? They are not addressed in GALL AMP XI.M38 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.

Markup:

~~*The scope of this program includes managing long-term loss of material due to general corrosion for steel components. Long-term loss of material due to general corrosion for steel components need not be managed if two conditions are met: (i) the environment for the steel components includes corrosion inhibitors as a preventive action; and (ii) periodic wall thickness measurements on a representative sample of each environment have been conducted every 5 years up to at least the 50th year of operation. Environments such as treated water, reactor coolant, raw water, and waste water do not typically include corrosion inhibitors.*~~

RESPONSE:

The staff partially agreed with this comment. Changes were incorporated as noted below.

The staff did not agree with deleting the text associated with long-term loss of material in the Scope of Program, program element. Long-term loss of material is an aging effect unique from loss of material. If loss of material associated with steel components is in part being managed by a preventive or mitigative action that includes corrosion inhibitors, then long-term loss of material might not need to be managed, unless plant-specific operating experience demonstrates otherwise. As such, long-term loss of material is not associated with in-scope components with an environment that includes corrosion inhibitors. The staff agreed with the third bullet. The staff has revised the recommendation to state that one representative sample (in lieu of periodic samples) conducted between the 50th year and 60th year of operation is sufficient to satisfy the recommendation in GALL-SLR Report AMP XI.M32, “One-Time Inspection.” The staff concluded that a one-time inspection conducted after 50 years of operation and some number of years during construction would be sufficient to provide input to expected corrosion rates that would occur through the end of the subsequent period of operation.

Additionally, in regard to deleting managing long-term loss of material from the Scope of Program program element of AMP XI.M32, there are no other AMPs, as written, that include a recommendation to conduct a representative sample of volumetric wall thickness measurements in and of themselves. Although the aging effects associated with raw water systems and waste water systems are managed by other programs (e.g., AMP XI.M20, “Open-Cycle Cooling Water System,” and AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”) neither of these programs recommend that a representative volumetric wall thickness examination be conducted. AMP XI.M20 states that qualitative inspections are conducted for loss of material and volumetric wall thickness examinations are only conducted as a follow up. AMP XI.M38 states that visual inspections are conducted to detect surface condition or wall thickness measurements are taken. The recommendation could be met by conducting only visual examinations.

Comment: 023

XI.M32-3 and -4, lines 41 and 1, Element 3,

Revise element 3 to reference Table XI.M32-1 by name.

- Examples of parameters monitored and the related aging effect are provided in the ~~*table*~~ Table XI.M32-1 ~~*in Element 4, below*~~.

RESPONSE:

The staff agreed with this comment. The changes was incorporated as requested. The editorial change had no effect on the technical content.

<u>Comment</u>: <u>024</u>

XI.M32–4, Table XI.M32-1, row 6

Recommend deleting long term loss of material aging effect.

- It would be difficult to satisfy the XI.M32 element 1 recommendation for representative samples conducted every 5 years up to at least the 50th year of operation.

- In addition, aging effects for raw water and waste water environments are more effectively managed by other AMPs.

RESPONSE:

The staff partially agreed with this comment.

Changes were incorporated as noted below. Each portion of the comment is addressed as follows:

- In regard to the portion of the comment related to the timing of inspections prior to the subsequent period of extended operation, see the response to Comment 017-022.

- In regard to the portion of the comment related to aging effects associated with components exposed to raw water or waste water, see the response to Comment 017-022.

The staff did not agree with the proposed markup to GALL-SLR Report AMP XI.M32, "One-Time Inspection." Deleting long-term loss of material from GALL-SLR Report Table XI.M32-1 would not be consistent with the importance of conducting these one-time inspections if they had not been conducted in the 50th to 60th year of operation.

<u>Comment</u>: <u>025</u>

XI.M32-2, Element 4

Revise element 4 regarding population for inspections, multiple units/same site

- Recommend combining all units on site in a single population from which to sample for multi-unit sites where the material and environment combinations are identical.

- This is consistent with the proposed treatment of corrective action applicability to all units if one unit identifies the need for periodic inspections.

- Recommend that any addition inspections be performed based on inspection results. Multiple unit stations will need to consider corrective actions at each unit.

- Recommend considering this multiple unit sample population approach for other one-time inspection AMPs such as XI.M33 Selective Leaching, and XI.M35 ASME Code Class 1 Small Bore Piping.

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

The staff provided a recommendation for a reduced number of site-wide inspections (e.g., a two-unit site would not need to conduct a maximum of 50 inspections in each inspection interval) for programs that conduct periodic inspections (e.g., AMP XI.M33, "Selective Leaching," AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," and AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks.") Using AMP XI.M38 as an example, two sets of representative samples will be conducted during the subsequent period of extended operation. However; given that AMP XI.M32, "One-Time Inspection," only conducts one representative sample of inspections within the 10-year period prior to the subsequent period of renewed operation, the staff concluded that it was not appropriate to reduce the number of inspections.

<u>Comment</u>: **<u>026</u>**

XI.M32-3, lines 14-15, Element 4

A representative sample size is 20 percent of the population or a maximum of 25 components at each unit or station of similar units.

<u>Markup</u>:

A representative sample 15 size is 20 percent of the population or a maximum of 25 components at each unit <u>or station of similar units</u>.

RESPONSE:

The staff did not agree with this comment. No changes were incorporated. See the response to Comment 017-025 above.

<u>Comment</u>: **<u>027</u>**

XI.M32-3, lines 32-30, Element 4

The following new statement should be deleted; this AMP has no AMR lines for inspections/air environments.

- "When using this AMP to conduct one-time inspections of aluminum piping, piping components and tanks exposed to air, […] and temper designation. Grouping of air environments consistent with the Detection of Aging Effects program element of GALL-SLR Report AMP XI.M38 is acceptable".

- The One-Time Inspection AMP does not include inspections in air environments.

Markup:

~~*When using this AMP to conduct one-time inspections of aluminum piping, piping components and tanks exposed to air, aluminum structures and components (SCs) […] Grouping of air environments consistent with the Detection of Aging Effects program element of GALL-SLR Report AMP XI.M38 is acceptable.*~~

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

The staff agreed that the GALL-SLR Report, as issued for public comment, did not contain any items associating the air environment with AMP XI.M32, "One-Time Inspection." However, the GALL-SLR Report and SRP-SLR Supplemental Staff Guidance document included many items that cited a plant-specific AMP and associated SRP-SLR further evaluation section that recommended a one-time inspection conducted in accordance with AMP XI.M32 and a search of plant-specific OE to manage loss of material and cracking for stainless steel and aluminum components exposed to air and condensation. The final version of the GALL-SLR Report cites numerous items associated with stainless steel, nickel alloy, and aluminum exposed to air or condensation citing AMP XI.M32.

Comment: **028**

XI.M32–4, Element 4; delete erosion from Table

Delete erosion from Table XI.M32-1.

- There are no AMR items for managing erosion in the One-Time Inspection program.

RESPONSE:

The staff agreed with this comment.

The change was incorporated as requested. GALL-SLR Report AMP XI.M32, "One-Time Inspection," is not cited to manage loss of material due to erosion. Loss of material due to erosion is managed by periodic programs or in one instance, a plant-specific program.

Comment: **029**

XI.M32–4, Element 4; revise Table to allow visual inspections with caveat,

Table XI.M32-1 requires volumetric examination for the identification of long-term loss of material due to general corrosion.

- Visual inspection should be allowed with the caveat that should evidence of degradation be observed visually, a volumetric examination shall be performed.

Source 017

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

Visual inspections might not detect significant loss of material if the material loss is relatively uniform in nature. If the loss rate is uniform in a circumferential and axially direction, the inspector would not have a sufficient frame of reference to determine the need for follow-up volumetric examinations. If an applicant has an acceptable basis for using visual inspections in lieu of volumetric examinations, they can propose an exception to the AMP.

Comment: 030

XI.M33-2, Lines 9-12, Element 2

Comment: Element 2 states that employing chemistry controls that are consistent with GALL-SLR Report AMP XI.M21A, Closed Treated Water Systems, "to control pH and concentration of corrosive contaminants, and treatment to minimize dissolved oxygen can be effective in minimizing selective leaching."

- The EPRI Closed Cooling Water Chemistry Guideline, which is referenced in AMP XI.M21A as acceptable water chemistry controls, does not control dissolved oxygen in closed cooling water systems unless hydrazine chemistry is used.
- Most closed cooling water systems do not control dissolved oxygen in the system or in the makeup water to the system, and air can enter via vents in the surge tanks.
- Some corrosion inhibitors used in closed cooling water systems are oxidizers or require dissolved oxygen in order to maximize their effectiveness. While dissolved oxygen is minimized in the PWR secondary cycle, it is not in most closed cooling water systems.
- Recommendation: Revise the sentence to read that chemistry control can be used to control pH, concentration of corrosive contaminants, or minimize dissolved oxygen.

Markup:

[…]Although the program does not provide guidance on preventive actions, water chemistry control consistent with GALL-SLR Report AMP XI.M2, "Water Chemistry," or GALL-SLR Report AMP XI.M21A, "Closed Treated Water Systems," to control pH, ~~*and*~~ concentration of corrosive contaminants, ~~*and treatment to*~~ or minimize dissolved oxygen

RESPONSE:

The staff agreed with the intent of this comment. The change was partially incorporated by deleting the specific AMPs and citing specific chemistry controls as examples.

The staff agreed that there is variability in chemistry controls in closed-cooling water systems. The staff concluded that eliminating the reference to specific AMPs, while retaining chemistry parameters that minimize selective leaching, provides adequate guidance in regard to chemistry controls in systems with materials susceptible to selective leaching.

<u>Comment</u>: <u>031</u>

XI.M33-3, line 9, Element 4 concerning destructive examinations

Recommend that the two mandatory destructive examinations noted in element 4 (page XI.M33-3 line 9) in each 10 year period in each material and environment population at each unit be reduced to one mandatory destructive examination for each population less than 100 components.

- This is based on 3% of 3 times (for three inspection periods) the inspection pool for a single period.
- Current sampling will result in oversampling of small-quantity material/ environment populations. For example, using 2 samples in each 10 year period will result in 6 samples. For a small population of twelve components, that is 50% of the population that will be replaced due to destructive examinations.

<u>Markup</u>:

[…]When inspections are conducted on piping, a 1-foot axial length section is considered as one inspection. In addition, two destructive examinations are performed in each material and environment population in each 10-year period <u>for sample populations with greater than 100 total susceptible components</u>~~. *at each unit*~~. When there are <u>less than 100 total susceptible components in a sample population, one destructive examination will be performed will be performed for that population.</u> Otherwise, […]

RESPONSE:

The staff partially agreed with this comment. The change was incorporated as requested; however, a different threshold was used for reducing the number of destructive examinations.

The staff agreed that a reduced number of destructive examinations would be acceptable when for a particular material and environment there is a small population. In one respect, an exception could be stated by applicants with a minimal number of components in a material and environment population. However, the staff concluded that it would be appropriate to address smaller populations within the AMP.

The basis for the reduced population size is as follows. The number of inspections proposed in the AMP, 3 percent of the population with a maximum of 10 components and 2 destructive examinations, is smaller than other sampling-based condition monitoring programs. For example, GALL-SLR Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” recommends 20 percent of the population with a maximum of 25 components. The inspection quantities in GALL-SLR Report AMP XI.M33, “Selective Leaching,” were reduced due to:

- opportunistic inspections will be conducted throughout the period of extended operation whenever components are opened, buried, or submerged surfaces are exposed, whereas opportunistic inspections were not recommended in the previous version of AMP XI.M33;
- destructive examinations provide a more effective means to detect and quantify loss of material due to selective leaching;

- the slow growing nature of selective leaching generally coupled with the inspections conducted prior to the initial period of extended operation provides insights into the extent of loss of material due to selective leaching that can be used in the subsequent period of extended operation;

- the staff's review of many license renewal applications (LRAs) has not revealed any instances where loss of intended function has occurred due to selective leaching;

- the staff's review of industry operating experience has not detected any instances of loss of material due to selective leaching, which resulted in a loss of intended function for the component; and

- regional inspector input (provided based on IP 71003, "Post-Approval Site Inspection for License Renewal,") that selective leaching has been noted during visual and destructive inspections; however, no instances have been identified where there was the potential for loss of intended function.

In addition, the Corrective Actions program element was revised to include a specific number of additional inspections if an inspection results in a determination that the affected component should be replaced prior to the end of the period of extended (i.e., a minimum of five additional visual inspections and one destructive examination) depending on which inspection method revealed the severity of the degraded condition. Using the 3 percent of the population as a basis, the staff concluded that for population sizes less than 35 (in lieu of the 100 proposed by the industry) is consistent with the sampling basis of the AMP. The Detection of Aging Effects program element was revised accordingly.

Comment: 032

XI.M33-3, line 22, Element 4 concerning destructive examinations

Recommend a similar reduction in element 4 (page XI.M33-3 line 22) for mandatory destructive examinations in two unit sites for each population at each unit of less than 50 components, such that there is a total of 100 components between the two units.

Markup:

For multi-unit sites where […]. For two unit sites with greater than 50 total susceptible components in a sample population at each unit, eight visual and mechanical inspections and two destructive examinations are conducted at each unit. For two unit sites with less than 50 total susceptible components in a sample population at each unit, one destructive examination will be performed for that sample population. For three unit sites, […]

RESPONSE:

The staff partially agreed with this comment.

The change was incorporated as requested; however, a different threshold was used for reducing the number of destructive examinations. The staff concluded that the sample population size should be 35 components (in lieu of the 50 proposed by the industry). The basis for this change is documented in the staff's evaluation of Comment 017-031.

<u>Comment</u>: <u>033</u>

XI.M35-1 through 3, all lines

The GALL 2 version recognizes that applicability could be system-oriented (as set forth in the GALL 2 Program Description section). However the GALL-SLR version has removed this system aspect, and implies that inspections must look at all components lumped together. The system orientation (especially systems with known plant or industry OE) of GALL 2 should be retained.

- Under GALL 2, a one-time inspection could show that many systems do not have an issue while perhaps a specific system or systems may have problems (for which a plant-specific program could then be implemented to monitor components in those systems).
- The GALL-SLR version implies that all systems are lumped together, and an issue in one system could drive unnecessary periodic inspections in many unaffected systems.
- GALL-SLR should contain language (or more clarification) so that applicants are not driven to do inspections where there is no history or indications of the particular socket or butt-weld internal cracking, or where past actions have totally mitigated it as borne out by absence of further failure at those locations.

RESPONSE:

The staff disagreed with this comment.

The GALL-SLR Report has not been changed. The program already has provisions for a plant-specific program based on the plant's OE.

<u>Comment</u>: <u>034</u>

XI.M35-3, lines 9-16, Operating Experience

Non-representative operating experience does not illustrate the need for AMP. OE that accurately portrays the issue should be used. Also, no justification is provided to show the need of periodic monitoring.

- One cited LER, 50-317/2012-002, is not representative of the issue since it involves ¾" tubing and was the result of a missing vertical support (construction error). This AMP is for piping NPS 1" through 4" and aging-related mechanisms.
- The GALL-SLR should use OE that accurately reflects the issue(s) at hand.
- Furthermore, if periodic inspections are being emphasized, then OE should be presented that reflects a need to perform periodic inspections; this LER was resolvable by ultimately installing the missing support. The AMP does not present any justification for advocating use of periodic inspections as a condition monitoring activity.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made.

Source 017

Licensee Event Report (LER) 50-317/2012-002 was removed; LER 50-387/2012-007 was added from the References section; the OE section was also modified to include the new LER. Staff agreed with the comment to use the more representative OE documented in the added reference.

Comment: **035**

XI.M35-5, move Table XI.M35-1 to better location

This Table should be moved to be before the References.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. Table XI.M35-1 was moved to right after the first paragraph of element 4 where it was first mentioned in this AMP.

Comment: **036**

XI.M35-5, Table XI.M35-1 Notes, Note 3

Add statement to Note 3 that repaired or redesigned welds demonstrating no additional failures should be placed into Category A.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. A modified sentence was added to the end of Note 3. It states that “If welds that have been redesigned or repaired and the applicant could demonstrate through operating experience that no additional failures have been reported for the last 30 years, then the inspection sample size could follow the guidance in Category A.” The modification also was needed to address Comment 017-038.

Comment: **037**

XI.M35-5, Table XI.M35-1, wording for Note 4

The following wording should be added to Note 4 to table XI.M35-1 in order to be consistent with wording in Element 4:

- “Other factors, such as plant-specific and industry operating experience, accessibility, and personnel exposure, can also be considered to select the most appropriate locations for the examinations.”

Markup:

(4) The welds to be examined are selected from locations that are determined to be the most risk significant and most susceptible to cracking. Other factors, such as plant-specific and industry operating experience, accessibility, and personnel exposure, can also be considered in selecting the most appropriate locations for the examinations.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. A sentence was added to the end of Note 4 as recommended by the commenter.

Comment: 038

XI.M35-5, Table XI.M35-1, Category B, change comment

With respect to Category B, the recommendation to inspect 10% (up 25) socket welds and butt welds may result in unnecessary inspections and destructive examinations of new welds, and thus run counter to the CAP and nullify QA as applied to this instance. Consider the following example:

- If the Category A inspections find cracking in a socket weld then the site's corrective action program would require a root cause determination and an extent of condition evaluation. The extent of condition evaluation could result in the identification of a subgroup of the socket weld population that potentially could be designated as Category B or C.

- A portion of these welds, possibly all, may need to be removed, redesigned, reconfigured, and installed based on the root cause determination. These welds would become Category B.

- The Category B requirements in table XI.M35-1 would require UT examination of these new welds (if UT techniques are available) or destructive inspection. This could place the site in the position of destructively examining new socket welds that have been redesigned to avoid the identified root cause.

- For Category B welds (welds that have been redesigned) the program should credit the corrective action program to correct the root cause. These welds, once corrected, should be placed back into the Category A weld population. Therefore, it is recommended that the Category B in table XI.M35-1 should be removed.

- If this Comment is not accepted, then please provide the flexibility for disposition of category B based on OE: that this table would allow flexibility, similar to that which is in GALL Rev. 2, that if OE searches of mitigated welds in category B show no additional failures for a 30 year period after the repair, then those welds can be reclassified as Category A.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made.

Note 3 changed in accordance with the comment recommendation. However, Category B will be retained for the plants that do not have 30 years of OE to demonstrate mitigation.

Source 017

Comment: 039

XI.M36–1, lines 8-10, Program Description “fouling” listed twice.

Fouling is listed twice as an aging effect in the 3rd sentence. Delete first instance of fouling

Markup:

The program manages aging effects through visual inspection of external surfaces for evidence of loss of material, cracking, ~~*fouling,*~~ changes in material properties, reduced thermal insulation resistance, and reduction of heat transfer due to fouling.

RESPONSE:

The staff agreed with this comment.

The editorial change was incorporated as requested. The staff reviewed all of the GALL-SLR Report AMR items and concluded that with the exception of A-797a, E-477a, and S-483a, none of them credit AMP XI.M36 to manage fouling except for reduction of heat transfer due to fouling. Items A-797a, E-477a, and S-483a should not have cited flow blockage due to fouling because it is not an applicable aging effect requiring management (AERM) for the external environment of polymeric components.

Comment: 040

XI.M36–1, lines 22-26, Element 3:

Revise element 3, insufficient details given.

- AMP has a new requirement “Periodic visual inspections or surface examinations are conducted on SS and aluminum to manage cracking. Periodic visual inspections are conducted where it has been demonstrated that leakage or surface cracks can be detected prior to a crack challenging the structural integrity or intended function of the component.”

- There is no detail on how this is to be demonstrated. Is this through the use of OE on past visual examinations? The use of OE to confirm that visual inspections are adequate is an acceptable way for demonstration.

- Revise to add the words “through the review of OE” after “demonstrated” to provide guidance for the demonstration required.

Markup:

Periodic surface examinations are conducted if this program is being used to manage cracking in SS or aluminum components. Visual inspections for leakage or surface cracks are an acceptable alternative to conducting surface examinations to detect cracking if it has been demonstrated through the review of OE that cracks will be detected prior to challenging the structural integrity or intended function of the component.

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

The proposed change to credit an undefined search of OE as a means to justify the use of visual inspections to detect cracking is not acceptable. It is not clear to the staff whether this would be a search of industry OE or plant-specific OE. In addition, it is not clear whether the OE search would compare similar inspection methodologies. For example, OE associated with the conduct of ASME Code Section XI VT-1 examinations should not be considered applicable to the type of visual inspections that occur during the walkdown of systems conducted for GALL-SLR AMP XI.M36, "External Surfaces Monitoring of Mechanical Components." See the staff's inclusion of alternatives to surface examinations described in the response to Comment 014-010.

Comment: 041

XI.M36-2, line 28, Element 3, regarding "surface discontinuities"

Change "surface discontinuities and imperfections" to "Corrosion and surface imperfections".

Basis:

The primary purpose of this program is to look for corrosion. The term "surface discontinuities" does not accurately describe corrosion.

Markup:

Corrosion and s~~S~~urface ~~*discontinuities and*~~ imperfections…

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested. The alternative wording adequately describes potential indications of loss of material and cracking.

Comment: 042

XI.M36-3 Lines 13-15, Element 4 editorial comment

First sentence is missing the word "to".

Markup: This program manages the aging effects of loss of material, cracking, changes in material properties using visual inspection, reduced thermal insulation resistance, and reduction of heat transfer due to fouling.

RESPONSE:

The staff agreed with this comment. The editorial change was incorporated as requested. The change corrects an editorial error.

Source 017

Comment: 043

XI.M36-3 Line 31, Element 4, periodic surface examinations

Remove recommendation for periodic surface examinations from these paragraphs.

- Surface examinations are impractical for system engineer walkdowns and opportunistic surface inspections. OE with code inspections and research in progress has demonstrated adequacy of visual inspections to detect cracking.

Markup:

~~Periodic visual inspections or surface examinations are conducted on SS and aluminum to manage cracking. Periodic visual inspections are conducted where it has been demonstrated that leakage or surface cracks can be detected prior to a crack challenging the structural integrity or intended function of the component. If visual inspections have not been demonstrated to effectively detect cracks prior to challenging the structural integrity or intended function of the component then a representative sample of surface examinations is conducted every 10 years during the period of extended operation. A minimum of 20 percent of the population (components having the same material, environment, and aging effect combination) or maximum of 25 components per population is inspected. The 20 percent minimum is surface area inspected unless the component is measured in linear feet, such as piping. Alternatively, any combination of 1-foot length sections and components can be used to meet the recommended extent of 25 inspections.~~

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

Objective evidence that system engineer walkdowns would be capable of detecting cracking was not provided. OE associated with "code inspections" should not be used to establish the effectiveness of system engineer walkdowns to detect cracking. In addition, incomplete "research in progress" does not provide the staff with sufficient evidence to remove the recommendation for surface examinations. See the staff's inclusion of alternatives to surface examinations described in the response to Comment 014-010.

Comment: 044

XI.M36–4, lines 37-40, Element 4(a), alternatives to removing insulation

The two alternatives to removing insulation in 4(a) after the initial inspection should clarify that the referenced observations are from the first inspection.

- Clarification is needed that referenced observations are from the first inspection of piping external surfaces and not observations during the current inspection.

Markup:

(i) No loss of material due to general, pitting, or crevice corrosion beyond that which could have been present during initial construction is observed during <u>the first inspection</u> and

(ii) No evidence of SCC is observed during the first inspection.

RESPONSE:

The staff partially agreed with this comment. The staff revised the phrase to read, “first set of inspections.”

The added wording clarifies the staff’s intent. The staff inserted the terms, “first set of inspections” to clarify that the conclusion is established after the completion of the 20 percent or maximum of 25 inspections. The term “during the first inspection,” might be interpreted as the completion of the first of 25 inspections.

Comment: 045

XI.M36–5, lines 37-40, Element 6

Revise the element 6 new acceptance criterion statement of “Where possible, acceptance criteria are quantitative” to “Quantitative acceptance criteria are preferred”

- So that it doesn’t preclude the use of qualitative criteria in cases where both are possible but quantitative is much more difficult to achieve.
- As currently written the statement doesn’t allow qualitative if quantitative can be performed.

Markup:

[…] Acceptance criteria, which permit degradation, are based on maintaining the intended function(s) under all CLB design loads. The evaluation projects the degree of observed degradation to the end of the subsequent period of extended operation or the next scheduled inspection, whichever is shorter. ~~*Where possible, acceptance criteria are q*~~Quantitative acceptance criteria are preferred (e.g., minimum wall thickness, percent shrinkage allowed in an elastomeric seal). Where qualitative acceptance criteria […]

RESPONSE:

The staff partially agreed with this comment. The requested change was incorporated with modification as described below. It is not the intent of the staff that quantitative acceptance criteria be established regardless of cost or personnel expenditures. However, the staff used the term “practical” versus the proposed “preferred.” The term “practical” is commonly used in consensus standards, such as ASME Code Section XI [e.g., IWA-1700 (b), IWA-2200 (c), IWA-4331 (e)].

Comment: 046

XI.M36-5, Element 6, acceptance criteria

Quantitative acceptance criteria are preferred and should be related to the surface condition. For example, acceptance criteria should be related to the surface condition such as ~~*no abnormal surface irregularities*~~, no visible loss of material greater than 1/10 of an inch due to corrosion, ~~*no degraded protective coating*~~, no crack-like indications, and no indications of recent leakage.

- Acceptance criteria should be associated with the parameters monitored or inspected and with the methods identified in detection of aging effects. Prior to initiating corrective actions, additional evaluations may be specified when acceptance criteria are not met.

RESPONSE:

The staff did not agree with this comment.

No changes were incorporated as a result of this comment. The staff has concluded that sufficient guidance has been provided in regard to acceptance criteria for this program. Examples of quantitative acceptance criteria were provided, "minimum wall thickness, percent shrinkage allowed in an elastomeric seal." The staff did not agree with two of the examples provided in the comment as follows:

- Citing 1/10 of an inch might lead the industry to believe that the staff accepts this magnitude of loss of material. An acceptable level of loss of material can only be established using plant-specific engineering documents.

- Recent or past signs of leakage should be evaluated for the potential to not meet acceptance criteria.

<u>**Comment**: **047**</u>

XI.M37-1, lines 21-28, Elements 3 and 4

Change "during the period of extended operation" to "during the <u>subsequent</u> period of operation" to be consistent with other AMPs.

- Editorial suggestion.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made.

<u>**Comment**: **048**</u>

XI.M38-1, second paragraph lines 18-20, Program Description

For clarity, state that loss of material is an aging effect managed by this program.

<u>Basis</u>:

A new sentence is being added to this paragraph via this revision that states that this program may also be used to manage cracking. However, the existing text has not yet stated that the program is monitoring for loss of material. For clarity, this should be stated.

Markup:

The program includes visual inspections to ensure that existing environmental conditions are not causing ~~material~~ degradation due to loss of material that could result in loss of a component's intended functions.

RESPONSE:

The staff partially agreed with this comment. A change was incorporated as described below, but not the change proposed by the industry.

The program manages aging effects other than loss of material and cracking (e.g., hardening and loss of strength due to elastomers degradation, reduction of heat transfer due to fouling). As a result, it would not be appropriate to singularly add the term, "loss of material." The second paragraph of the Program Description adequately describes the intent of the program, "[t]his program includes visual inspections and when appropriate, surface examinations." The underlined wording was added as a result of this comment. The term "material degradation" adequately encompasses all of the aging effects managed by the program. Additionally: (a) the Parameters Monitored or Inspected program element provides several examples of aging effects for metallic, elastomeric, polymeric, and cementitious materials; and (b) the GALL-SLR Report AMR items specifically cite the aging effects for each item that cites GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components."

Comment: 049

XI. M38–2, lines 29-30, Element 3

Revise element 3 to insert "Additional aging indicators include" just before the last three items which are not related to loss of material as described, but are related to other aging effects such as fouling and cracking.

Markup:

Additional aging indicators include (insert this new line)

- Debris from the air environment accumulating on heat exchanger tube surfaces (reduction of heat transfer due to fouling)
- Surface examinations for the detection of cracks on the surfaces of SS and aluminum components exposed to air and aqueous solutions containing halides
- Leakage for detection of cracks on the surfaces of SS and aluminum components exposed to air and aqueous solutions containing halides.

RESPONSE:

The staff agreed with this comment. A change was incorporated similar to the industry's request. The two headers (i.e., metallic, polymeric) were changed to, "[e]xamples of aging effects for." With this change, all of the aging effects under the header are appropriately characterized.

Source 017

Comment: 050

XI.M38-2, line 27, Element 3, surface discontinuities

Change “surface discontinuities and imperfections” to “Corrosion and surface imperfections”.

Basis:

The primary purpose of this program is to look for corrosion. The term “surface discontinuities” does not accurately describe corrosion.

Markup:

Corrosion and s~~S~~urface ~~*discontinuities and*~~ imperfections

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested. The alternative wording adequately describes potential indications of loss of material and cracking.

Comment: 051

XI.M38–2, lines 21-25, Element 3, insufficient details given

Revise element 3.

- AMP has a new requirement “Periodic surface examinations are conducted if this program is being used to manage cracking in SS or aluminum components. Visual inspections for leakage or surface cracks are an acceptable alternative to conducting surface examinations to detect cracking if it has been demonstrated that cracks will be detected prior to challenging the structural integrity or intended function of the component.
- There is no detail on how this is to be demonstrated. Is this through the use of OE on past visual examinations? The use of OE to confirm that visual inspections are adequate is an acceptable way for demonstration.
- Revise to add the words “through the review of OE” after “demonstrated” to provide guidance for the demonstration required.

Markup:

Periodic surface examinations are conducted if this program is being used to manage cracking in SS or aluminum components. Visual inspections for leakage or surface cracks are an acceptable alternative to conducting surface examinations to detect cracking if it has been demonstrated through the review of OE that cracks will be detected prior to challenging the structural integrity or intended function of the component.

RESPONSE:

The staff did not agree with this comment. See the response to Comment 017-040. See the staff's inclusion of alternatives to surface examinations described in the response to Comment 014-010.

Comment: 052

XI.M38-3, lines 1-2, Element 3

At the top of page XI.M38-3, this item should not be bulleted.

Editorial

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested. The editorial change had already been incorporated into the GALL-SLR and SRP-SLR Supplemental Staff Guidance document.

Comment: 053

XI.M38-4 Line 13-ff, Element 4

Remove recommendation for periodic surface examinations from these paragraphs.

- Surface examinations are impractical for system engineer walkdowns and opportunistic surface inspections. OE with code inspections and research in progress has demonstrated adequacy of visual inspections to detect cracking.

Markup:

~~Periodic visual inspections or surface examinations are conducted on SS and aluminum to manage cracking. Periodic visual inspections are conducted where it has been demonstrated that leakage or surface cracks can be detected prior to a crack challenging the structural integrity or intended function of the component. If visual inspections have not been demonstrated to effectively detect cracks prior to challenging the structural integrity or intended function of the component then a representative sample of surface examinations is conducted every 10 years during the period of extended operation. A minimum of 20 percent of the population (components having the same material, environment, and aging effect combination) or maximum of 25 components per population is inspected. The 20 percent minimum is surface area inspected unless the component is measured in linear feet, such as piping. Alternatively, any combination of 1-foot length sections and components can be used to meet the recommended extent of 25 inspections.~~

RESPONSE:

The staff did not agree with this comment. See the staff's inclusion of alternatives to surface examinations described in the response to Comment 014-010.

Source 017

<u>Comment</u>: **<u>054</u>**

XI.M38-4, lines 26-27, Element 4, third paragraph

Clarify the word “accessible”.

<u>Basis</u>:

The intent of this paragraph may be confusing without this clarification.

<u>Markup</u>:

To determine the condition of internal surfaces of buried and underground piping, inspections of the interior surfaces of accessible <u>(i.e., above ground)</u> piping may be credited if the accessible and buried or underground component material, environment, and aging effects are similar.

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested.

Adding the parenthetical statement is consistent with the staff’s position that the internal surfaces of above ground piping may be inspected in lieu of the internal surfaces of buried or underground piping give that the conditions stated in the cited paragraph are met.

<u>Comment</u>: **<u>055</u>**

XI.M38–6 Element 6

Revise element 6 new acceptance criteria of “Where possible, acceptance criteria are quantitative” to “Quantitative acceptance criteria are preferred” such that is doesn’t preclude the use of qualitative criteria in cases where both are possible but quantitative is much more difficult to achieve. As currently written it wouldn’t allow qualitative if quantitative can be performed.

<u>Markup</u>

(Element 6): For each component and aging effect combination, […] The evaluation projects the degree of observed degradation to the end of the subsequent period of extended operation or the next scheduled inspection, whichever is shorter. ~~*Where possible, acceptance criteria are q*~~<u>Quantitative acceptance criteria are preferred</u> (e.g., minimum wall thickness, percent shrinkage allowed in an elastomeric seal). Where qualitative acceptance […].

RESPONSE:

The staff partially agreed with this comment. The requested change was incorporated with modification as described below. It is not the intent of the staff that quantitative acceptance criteria be established regardless of cost or personnel expenditures. However, the staff used the term “practical” versus the proposed “preferred.” The term “practical” is commonly used in consensus standards, such as ASME Code Section XI [e.g., IWA-1700 (b), IWA-2200 (c), IWA-4331 (e)].

<u>Comment</u>: <u>056</u>

XI.M38-5, lines 15-29, Element 6

Acceptance criteria should be related to the surface condition since this program inspects surfaces for evidence of degradation.

- For example, acceptance criteria should be similar to criteria like no abnormal surface irregularities, no visible loss of material due to corrosion, no degraded protective coating, no crack-like indications, and no indications of recent leakage.

- Acceptance criteria should be associated with program elements' aspects: the parameters monitored or inspected and the methods identified in detection of aging effects. Corrective actions should identify the additional evaluations that should take place following not meeting acceptance criteria.

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

The Acceptance Criteria program element provides broad general recommendations for establishing acceptance criteria. For example:

- Acceptance criteria are developed from plant-specific design standards and procedural requirements, current licensing basis (CLB), industry codes or standards (e.g., ASME Code Section III, ANSI/ASME B31.1), and engineering evaluation.

- Where practical, acceptance criteria are quantitative.

- Where qualitative acceptance criteria are used, the criteria is clear enough to reasonably ensure that a singular decision is derived based on the observed condition of the SSC.

Current licensing bases, codes, plant-specific design standards, etc., vary across the industry. The Acceptance Criteria program element recommendations in GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," provide broad general principles that apply regardless of plant-specific details and can result in effective acceptance criteria.

<u>Comment</u>: <u>057</u>

XI.M38-4, lines 26-33, Element 4

Delete paragraph and replace.

<u>Markup</u>

- Delete: To determine the condition of internal surfaces of buried and underground piping, inspections of the interior surfaces of accessible piping may be credited if the accessible and buried or underground component material, environment, and aging effects are similar. When inspections of the interior surfaces of accessible components with similar material, environment, and aging effects as the interior surfaces of buried or underground piping are not conducted, the sample population will be inspected using volumetric or internal visual inspections capable of detecting loss of material on the internal surfaces of the buried or underground piping.

- Replace with: If accessible portions of buried or underground components have similar material, environment, and aging effects as the inaccessible buried or underground components, then inspections of the interior surfaces of accessible components may be credited. If not, then the sample population will be inspected using volumetric or internal visual inspections capable of detecting loss of material on the internal surfaces of the inaccessible buried or underground piping.

RESPONSE:

The staff partially agreed with this comment. The staff clarified its intent by stating that the accessible piping is aboveground piping. See the response to Comment 017-054.

The industry's proposed wording does not convey the staff's intent that the internal surfaces of <u>any</u> aboveground components with similar materials, environments, and aging effects, as that for buried or underground piping may be inspected in lieu of inspecting the internal surfaces of the buried and underground piping.

<u>**Comment**: **058**</u>

XI.M39–1, lines 39-42, Element 4

In Detection of aging effects the use of the One Time Inspection (OTI) program to confirm effectiveness of this program is inconsistent with other programs that credit it.

- The AMP doesn't explicitly mention OTI, yet states "In certain cases, as identified by the AMR Items in this GALL-SLR Report, inspection of selected components is to be undertaken to verify the effectiveness of the program and to ensure that significant degradation is not occurring and that the component intended function is maintained during the subsequent period of extended operation." All AMR lines in the GALL-SLR that reference also specify the use of XI.M32 One-time Inspection to verify effectiveness of XI.M39 Lubricating Oil Analysis Program.

- Change to "Prior to the subsequent period of extended operation, a one-time inspection (i.e., GALL-SLR Report AMP XI.M32) of selected components exposed to lubricating oils is performed to verify the effectiveness of the Lubricating Oil Analysis program."

<u>Markup</u>

- Delete: In certain cases, as identified by the AMR Items in this GALL-SLR Report, inspection of selected components is to be undertaken to verify the effectiveness of the program and to ensure that significant degradation is not occurring and that the component intended function is maintained during the subsequent period of extended operation.

- Replace with: Prior to the subsequent period of extended operation, a one-time inspection (i.e., GALL-SLR Report AMP XI.M32) of selected components exposed to lubricating oil is performed to verify the effectiveness of the Lubricating Oil Analysis program.

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

Given the clarity of the AMR items (as referenced in the Detection of Aging Effects program element) in regard to citing GALL-SLR Report AMP XI.M32, "One-Time Inspection," and the AMP recommendation to conduct a one-time inspection as stated in the Program Description, the staff concluded that no change is required. The staff's intent is clear.

Comment: 059

XI.M40–1, lines 6-8, Program Description contains information out of place.

In the Program Description the sentence "Information Notice (IN) 2009-26, Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool, discusses the degradation of Carborundum as well as the deformation of Boral panels in spent fuel pools."

- This is not appropriate for a program description as it is OE and should be in the OE section.

Markup:

(Program Description) Many neutron-absorbing materials are used in spent fuel pools. This aging management program (AMP) addresses aging management of spent fuel pools that use materials other than Boraflex, such as Boral, Metamic, boron steel, and Carborundum. ~~*Information Notice (IN) 2009-26, Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool, discusses the degradation of Carborundum as well as the deformation of Boral panels in spent fuel pools.*~~ GALL-SLR Report AMP XI.M22, "Boraflex Monitoring," addresses aging management of spent fuel pools that use Boraflex as the neutron-absorbing material. When a spent fuel pool criticality analysis credits both Boraflex and materials other than Boraflex, the guidance in both AMPs XI.M22 and XI.M40 applies.

Relocated to: (10, Operating Experience) Applicants for license renewal reference plant-specific operating experience and industry experience to provide reasonable assurance that the program is able to detect degradation of the neutron absorbing material in the applicant's spent fuel pool. Some of the industry operating experience that should be included is listed below and discussed in Information Notice (IN) 2009-26, Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool: […]

RESPONSE:

The staff agreed with this comment.

The information is OE and should be moved to that section of the AMP. The staff removed from the program description, "Information Notice (IN) 2009-26, Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool, discusses the degradation of Carborundum as well as the deformation of Boral panels in spent fuel pools," and added to the second sentence in the first paragraph of the Operating Experience program element, "…discussed in Information Notice (IN) 2009-26, Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool, and…"

Source 017

Comment: 060

XI.M40–1, lines 39-41, Element 4

A new requirement of "The maximum interval between inspections for polymer-based materials (e.g., Carborundum, Tetrabor), regardless of operating experience, should not exceed 5 years." has been added without any basis being provided. This needs to be revised.

- There is no basis for the need for inspections more frequent than every 10 years unless existing program OE indicates a need for a shorter interval.
- A review of OE for carborundum found no OE justifying this change. It did find a commitment at a utility that "sample coupons will be removed and inspected on a 10-year interval, implemented on a staggered basis with the BADGER testing, such that either neutron attenuation testing (BADGER) or sample coupon testing will occur approximately every 5 years. This program only performs the inspections and testing every 10 years based on plant OE, not every 5 years.

Markup:

The loss of material and the degradation of neutron absorbing material capacity are determined through coupon and/or direct in-situ testing. Such testing should include […] experience by the licensee. The maximum interval between inspections for polymer-based materials (e.g., Carborundum, Tetrabor), ~~*regardless of operating experience, should not exceed 5 years. The maximum interval between inspections for*~~ and nonpolymer-based materials [(e.g., Boral, Metamic, Boralcan, borated stainless steel (SS)], regardless of operating experience, should not exceed 10 years.

RESPONSE:

The staff did not agree with this comment.

Operating experience suggests that Carborundum may be an issue due to the fact that it is a polymeric material that degrades similarly to Boraflex by breakdown of polymer chains. Because licensees do not have the benefit of monitoring silica, the NRC staff agreed to increase the surveillances of polymeric materials like Carborundum. There has been active degradation of polymeric materials, which warrants the increased inspection frequency. Relevant OE was also included as part of this AMP.

Comment: 061

XI.M42-1, lines 23-32, Element 1, inconsistent standards applied to tanks.

The proposed AMP wording states: *"The aging effects associated with fire water tank internal coatings/linings are managed by Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) aging management program (AMP) XI.M27, "Fire Water System," instead of this AMP. However, where the fire water storage tank internals are coated, the Fire Water System Program and Final Safety Analysis Report (FSAR) Summary Description of the Program should be enhanced to include the recommendations associated with training and qualification of personnel and the "corrective actions" program element. The Fire Water System Program* *should also be enhanced to include the recommendations from the "acceptance criteria" program element."*

- This wording indicates that the aging management of internally coated fire water storage tanks would be in accordance with XI.M27, Fire Water System". This is consistent with LR-ISG-2013-01 section VI.a.ii.

- However, this guidance is contradicted by SLR GALL line items VII.G.A.414 and VII.G.A.416 in which the aging of internally coated tanks is managed by XI.M42.

RESPONSE:

The staff agreed with this change. The change was incorporated as requested.

GALL-SLR Report AMR items VII.G.A-414 and VII.G.A-416, for which aging effects are managed by GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," were revised to remove fire water storage tanks from the scope of the items. As recommended in the GALL-SLR Report, aging effects associated with fire water storage tanks are managed by AMP XI.M27, "Fire Water System," not AMP XI.M42. Items A-623 and A-744 manage aging effects associated with aluminum fire water storage tanks, A-745 and A-747 address stainless steel tanks, and A-412 addresses steel tanks.

Comment: 062

XI.M42-3, line 8, Element 4

Add a qualifier that baseline inspections are only required for sites that have no already performed those inspections

- For sites that have completed baseline inspections already, their periodic inspections have already been defined.

Markup:

(Element 4) Detection of Aging Effects: If a baseline has not been previously established, b~~B~~aseline coating/lining inspections occur in the 10-year period prior to the subsequent period of extended operation.

RESPONSE:

The staff agreed with this comment in part. The staff incorporated this change substantially as requested; however, the change incorporated a recommendation that the baseline be conducted in the 50^{th} – 60^{th} year of operation.

The staff initially concluded that baseline inspections should be conducted between the 50^{th} and 60^{th} year of operation to provide an effective baseline for entering a subsequent period of extended operation. The change was incorporated into the GALL-SLR Report and SRP-SLR Supplemental Staff Guidance documents. However, the staff subsequently deleted the reference to the 50^{th} – 60^{th} year of operation. The staff's basis for this change is documented in the response to Comment 045-078.

Source 017

<u>Comment</u>: <u>063</u>

Summary for XI-M38,

The row for XI.M38, Inspection of Internal Surfaces In Miscellaneous Piping And Ducting Components, states "This program consists of visual inspections of 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 environment other than open-cycle cooling water, closed-cycle cooling water, and fire water."

- Open-cycle cooling water, closed-cycle cooling water, and fire water are not water environments. The proper terms are treated water and raw water. This program manages components exposed to a raw water environment. Needs to be revised to be consistent with the program description in XI.M38.

RESPONSE:

The staff partially agreed with this comment. A change, described below, was incorporated; however, different than as proposed by the industry.

The staff agreed with this comment with minor changes. The changes add clarity to the Updated Final Safety Analysis Report (UFSAR) Supplement Description consistent with the Program Description in GALL-SLR Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." As stated by the industry, the environment cited in the GALL-SLR Report for these three programs is not water, but rather environments, such as, raw water, treated water, etc. The staff revised the Program Description and Final Safety Analysis Report (FSAR) Supplement description to be focused on system names, in place of the mix of systems and environments.

<u>Comment</u>: <u>064</u>

Summary for XI.M42

In the SAR supplement XI.01 row for XI.M42 Internal Coatings/Linings for In Scope Piping, Piping Components, Heat Exchangers, and Tanks, the following acceptance criteria was added to what was in ISG-2013-01. "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 other degraded conditions are evaluated by a coatings specialist."

- This is only part of the acceptance criteria in XI.M42 and may or may not be appropriate for all applicants. Recommend removing.

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

The staff has concluded that not all aspects of an AMP are incorporated into Table XI-01, "FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management of Applicable

Systems for SLR." The staff evaluates each of the recommendations in an AMP and incorporates those that are most significant for managing aging effects. By incorporating the more significant recommendations, the staff has reasonable assurance that changes to these recommendations are managed via the applicant's 10 CFR 50.59 process. In the case of GALL-SLR Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," the staff incorporated those aspects of the recommendations associated with acceptance criteria that it deemed most significant. Specifically, the FSAR supplement description includes aging effects associated with potential peeling, delamination, blistering, and minor cracks of concrete (the text allows only minor cracks). These mechanisms can not only result in unanticipated corrosion at the degraded location, but also potential downstream aging effects. Other aging effects, such as flaking and rusting, are less likely to result in downstream aging effects. In regard to the portion of the comment that states, "[m]ay or may not be appropriate for all applicants," if a degradation mechanism is not applicable, the applicant would not include that portion of the FSAR AMP summary description in its LRA Appendix A and the staff would evaluate its exclusion.

Source 018: NEI Attachment 5—Mechanical AMP XI.M31

Comment: 001

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31-1, 3-7 Program Description

The opening sentence seems to imply all beltline materials with projected fluence greater than 10^{17} n/cm^2 need to be monitored per 10 CFR 50 Appendix H.

- 10 CFR 50 Appendix H says all RVs with fluence exceeding 10^{17} n/cm^2 need to have a surveillance program not all materials.
- Plants can monitor all these materials, but cannot test or irradiate them all since some are not available either in unirradiated or irradiated condition.
- Recommend adding the words "that contains a representative subset of those materials".

RESPONSE:

The staff agreed with this comment.

The staff amended the first sentence in the first paragraph of the program description of GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance," by dividing the sentence into two sentences that now state:

> "Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix H, requires implementation of a Reactor Vessel Material Surveillance program when the peak neutron fluence at the end of the design life of the vessel exceeds 10^{17} n/cm^2 (E > 1 MeV). The purpose of the material surveillance program is to monitor the changes in fracture toughness to the ferritic reactor vessel beltline materials."

In order to avoid potential misconceptions that all reactor pressure vessel (RPV) materials are monitored in the vessel material surveillance program, the first paragraph of the Program Description was modified to include separate statements that a surveillance program is required when the vessel fluence exceeds 10^{17} n/cm^2 (E > 1 MeV) and the program monitors the changes in fracture toughness of the RPV materials.

Comment: 002

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31-1, 10 Program Description:

- A capsule holder within reactor vessel may be located in a low lead factor region (i.e., < 1.0), therefore a capsule located in such a holder will not “lead” the vessel. Requiring all capsules to lead the RV would be an increase in regulatory requirements.

- Recommend adding “typically” after “surveillance capsules”.

RESPONSE:

The staff agree with this comment. The staff modified the referenced program description sentence by adding the word “typically” after the words "surveillance capsules” in the sentence. The sentence now reads:

> “Because of the location of the capsules between the reactor core and the reactor vessel wall, surveillance capsules typically receive neutron fluence exposures that are higher than the inner surface of the reactor vessel.”

The staff agreed that the neutron exposure lead factors may not be greater than a value of 1.0 for all RPV surveillance capsules in plant-specific or integrated RPV surveillance programs. The modification of the referenced sentence reflects the reality that, for some plants, the surveillance capsules may not receive neutron fluence exposures that are higher than the peak fluence on the inner surface of the RPV.

Comment: **003**

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR) XI.M31-1, 16, XI.M31-1, 29, and XI.M31-2, 7 Program Description:

States that program must comply with ASTM E185-82.

- Many programs were built to an earlier version of E185 and cannot practically comply with the E185-82 version.

- 10 CFR 50 Appendix H is being updated to reference the latest version of the applicable ASTM standards.

- Recommend stating that the surveillance program must comply with 10 CFR 50 Appendix H.

RESPONSE:

The staff agreed with this comment.

The staff amended the referenced aging management program (AMP) description sentence to cite compliance with 10 CFR Part 50, Appendix H, rather than providing a reference to a specific American Society for Testing and Materials (ASTM) standard. The sentence now reads:

> “The surveillance program must meet the requirements of 10 CFR Part 50, Appendix H.”

The staff agreed that many RPV surveillance programs were designed to program criteria in earlier editions of ASTM Standard Practice Designation E185, such as those in the 1973 or 1979 editions of the standard practice designation. The change to the referenced sentence is consistent with U.S. Nuclear Regulatory Commission (NRC) regulations.

Comment: 004

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–1 Program Description:

Line 26 (et al) The requirement of testing a capsule with a neutron fluence of 1 to 1.25 times the projected peak vessel neutron fluence at the end of the subsequent period of extended operation may be too restrictive for plants that are in an integrated surveillance program since plants with different operating history can be associated with a tested capsule. It is suggested that the requirement be maintained at 1 to 2 times the peak projected fluence.

- Further irradiation beyond the peak projected fluence at the end of the subsequent period of extend operation should be bounding, therefore there appears to be no value in capping it at 1.25 times.

RESPONSE:

The staff agreed with this comment. The staff modified the referenced AMP program description sentence to state:

> "This program includes withdrawal and testing of at least one surveillance capsule addressing the subsequent period of extended operation, with a neutron fluence of the surveillance capsule between one and two times the peak neutron fluence of interest projected at the end of the subsequent period of extended operation."

The staff agreed that the referenced fluence range for the AMP should be listed as one to two times the peak projected fluence of interest for the RPV, at the end of the subsequent period of extended operation, where the peak neutron fluence of interest addresses the time-limited aging analysis (TLAAs) applicable to the plant, as described in SRP-SLR Section 4.2, and performed in accordance with the licensing basis for the facility. There is no substantial benefit to overly restrict the fluence range for the surveillance capsules, and thus this change modified the range.

Comment: 005

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–1 line 25, and M31-3 lines 11-12

GALL, Revision 2 states that "Additional capsules may also be needed for the period of extended operation for this alternative."

However, GALL for SLR states that "This program includes removal and testing of at least one capsule during the subsequent period of extended operation..."

- This change indicates a firm position of the NRC that at least one capsule will be tested in the SLR period whereas the previous position was that it was a possibility that one may be needed. The absolute need for testing of additional capsules in the SLR period is not substantiated.
- Many plants will have tested all of their capsules by the end of the first license renewal period. PWR plants are likely to have 5 or 6 capsules with substantial lead factors that enabled the already pulled capsules to provide data at fluence values in excess of SLR peak values.
- The GALL-SLR requirement will result in these plants inserting another capsule during the SLR period. This capsule will result in one additional data point that is already within the range of fluence values already provided by the existing surveillance results.
- One additional data point, when 5 or 6 data points are already available, is very unlikely to have any discernable effect on chemistry factors or embrittlement trend observations. For weld heats that are present in multiple reactors, in excess of 10 data points may already exist. This even further negates the value of testing additional capsules.
- Insertion of a capsule is high expense and is not without risk but would offer little technical benefit and negligible improvement in safety.
- It is agreed that a capsule should be within the surveillance program that provides data at a fluence value representative of end of operating period conditions. There are some plants that do not have a capsule currently in their program that would provide data at end of SLR fluence values. In these cases, an additional capsule may be needed.

RESPONSE:

The staff partially agreed with this comment. The staff amended the program description and the "Parameters Monitored or Inspected" program element of the AMP to include the following statements:

> "This program includes withdrawal and testing of at least one surveillance capsule addressing the subsequent period of extended operation, with a neutron fluence of the surveillance capsule between one and two times the peak neutron fluence of interest projected at the end of the subsequent period of extended operation."
>
> "If a capsule meeting this neutron fluence criterion has not been tested prior to entering the subsequent period of extended operation, then the program includes the withdrawal and testing (or alternatively the retrieval from storage, reinsertion for additional neutron fluence accumulation, if necessary, and testing) of one capsule addressing the subsequent period of extended operation to meet this criterion."

The staff did not agree that the AMP's basis for removing a RPV surveillance capsule during a proposed subsequent period of extended operation is necessarily unwarranted, but did agree that specifying withdrawal and testing of a capsule during the subsequent period of extended operation would not be necessary if a capsule meeting the neutron fluence criterion was previously withdrawn and tested.

Comment: 006

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI.M31-1, Line 25 and XI.M31-3, Lines 11-12,

Two further recommendations on the above topic:

- Remove “during the subsequent period of extended operation.”
- Recommend adding “If a capsule with recommended fluence has already been tested, then additional testing is not required.”

RESPONSE:

The staff partially agreed with this comment. Consistent with the staff’s basis for resolving Comment 018-005, the staff amended the program description and the Parameters Monitored or Inspected program element of the AMP to include the following statements:

> “This program includes withdrawal and testing of at least one surveillance capsule addressing the subsequent period of extended operation, with a neutron fluence of the surveillance capsule between one and two times the peak neutron fluence of interest projected at the end of the subsequent period of extended operation.”
>
> “If a capsule meeting this neutron fluence criterion has not been tested prior to entering the subsequent period of extended operation, then the program includes the withdrawal and testing (or alternatively the retrieval from storage, reinsertion for additional neutron fluence accumulation, if necessary, and testing) of one capsule addressing the subsequent period of extended operation to meet this criterion.”

Comment: 007

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI.M31-1 line 26, M31-3 line 13, and M31-4 line 37

GALL, Revision 2 states that “The program withdraws one capsule at an outage in which the capsule receives a neutron fluence of <u>between one and two times</u> the peak reactor vessel wall neutron fluence at the end of the period of extended operation…”

However, the proposed GALL for SLR states “This program includes removal and testing of at least one capsule…with a neutron fluence of the capsule <u>between one and one and one quarter (1.25) times</u> the projected peak neutron fluence…” Several reasons indicate that this should be changed:

- No apparent basis is given for this “tightening” of the target fluence range for the end of the period of operation.

- Operation for an additional 20 years should not necessitate tighter tolerance in fluence exposure for the highest fluence capsule.

- The latest industry consensus standard ASTM Standard, E2215, was developed with extended operation being considered, and this standard retains a target of between one and two times end of life fluence.

- The embrittlement curve flattens out at high fluence, therefore meaningful metallurgical data can be obtained with a fluence higher than 1.25x.

- The limitation for having fluence 1-1.25 the projected vessel fluence is too burdensome for plant operations. If a rule of thumb for plant calculated fluence is +/- 20%, then more leeway needs to be granted for capsule fluence value (recommend keeping up to 2 times SLR fluence).

- Irradiation embrittlement is primarily a fluence driven effect. The latest version of ASTM E900 identifies an embrittlement trend curve that has no consideration of flux effects. As such, time effects for surveillance data are of very minor significance. <u>Many plants have a capsule that provide fluence data that is representative of SLR conditions but was withdrawn prior to the SLR period. This data should not be discredited</u> strictly because it did not have the same time exposure as a capsule pulled within the SLR period.

- For plants with remaining capsules at higher lead factors, waiting and pulling an existing capsule in the SLR period will likely cause the capsule to have a fluence higher than 1.25, or even 2 times, the peak vessel fluence. It may be that by the time a plant makes the decision to pursue SLR, the 1.25 fluence target for the remaining capsule may have been exceeded.

RESPONSE:

The staff agreed with this comment.

The staff modified the Parameters Monitored or Inspected program element of GALL-SLR Report AMP XI.M31, “Reactor Vessel Material Surveillance,” to state:

> “This program includes withdrawal and testing of at least one capsule addressing the subsequent period of extended operation with a neutron fluence of the capsule between one and two times the peak neutron fluence of interest at the end of the subsequent period of extended operation.”

<u>**Comment**: **008**</u>

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI.M31-1, Line 26, XI.M31-3, Line 13 and XI-M31-4, Line 37, Recommends the capsule fluence be between 1 and 1.25 of the SLR peak RV fluence.

- The lead factors for some remaining capsules in some plant designs are near or below 1.
- Without significant effort, these capsules cannot be used to meet the above requirement, even if moved to a higher lead factor location; some of these capsules cannot catch-up in time to reach the SLR peak fluence.
- Embrittlement beyond 0.9 peak fluence to the peak fluence [sic] is not expected to be any different than below this point. The data to this point can be used to establish the trend per 10 CFR 50.61 with extrapolation to the projected peak vessel neutron fluence.
- A small extrapolation is reasonable considering that no unexpected embrittlement behavior has been identified in the extensive U.S. embrittlement data to fluences that exceed the projected SLR peak values.
- The plants with low lead factors, in general, have lower peak fluences relative to other U.S. operating plant designs.
- The fluence at the 1/4T location used for P-T curves is about two-thirds the peak ID fluence; therefore a value of 90% of the peak would still exceed the P-T curve fluence.
- The projected peak fluence data is relevant to PTS values (PWRs). The 1X requirement could be imposed for RPV materials in the surveillance program which are close to the PTS screening limit, while relaxed for surveillance materials where there is ample margin to PTS screening limits. 28°F is recommended since this is the larger embrittlement uncertainty identified in 10 CFR 50.61.
- An allowable lower fluence threshold would also allow plants with a low lead factor to produce measured data sooner. Therefore, if unexpected embrittlement is encountered, the plant can make adjustments to address earlier in the SLR operational period.
- Recommend the following: “For PWRs this program includes removal and testing of at least one capsule with a neutron fluence of the capsule between one and two times the projected peak vessel neutron fluence at the end of the subsequent period of extended operation. However, for plants with an SLR capsule with a lead factor of 1.2 or less and that have a margin to the PTS screening criteria greater than 28°F for RPV materials in the surveillance program, the SLR capsule fluence can have a fluence as low as 0.9 times the projected peak vessel neutron fluence.”

RESPONSE:

The staff agreed with this comment. Consistent with the staff’s basis for resolving Comments 018-004 and 018-007 above, the staff modified the Parameters Monitored or Inspected program element in GALL-SLR AMP XI.31, “Reactor Vessel Material Surveillance,” to state:

> “This program includes withdrawal and testing of at least one capsule addressing the subsequent period of extended operation with a neutron fluence of the capsule between one and two times the peak neutron fluence of interest at the end of the subsequent period of extended operation.”

The staff concluded that there is no substantial benefit to overly restrict the fluence range for the surveillance capsules, and thus has modified the range. In addition, the fluence range is not necessary the peak RPV fluence, but depends on the plant current licensing basis.

Comment: **009**

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31-1, line 29

The wording may be confused with an SRP plant-specific aging management program. Proposed wording below is consistent with the rest of the AMP.

- Third paragraph under Program Description (line 29): As an alternative to a ~~*plant-specific*~~ surveillance program complying with…

RESPONSE:

The staff agreed with this comment. The staff amended the third paragraph of program description for GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance," but using wording slightly different from the wording proposed by the commenter for integrated surveillance capsule clarifications. The staff revised the paragraph to state:

> "An integrated surveillance program (ISP), alternatively, may be considered for a set of reactors that have similar design and operating features, as described in 10 CFR Part 50, Appendix H, 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 U.S. Nuclear Regulatory Commission (NRC) for the subsequent period of extended operation."

The staff considered the change recommendations in the comment to be strictly editorial. The modified wording is consistent with regulation and requirements in 10 CFR Part 50, Appendix H.

Comment: **010**

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31-1, M31-2 and M31-3, etc., various lines re: capsule withdrawal schedule:

It is unclear whether NRC approval of changes to the capsule testing schedule would need to be obtained prior to the submittal of the subsequent license renewal application (SLRA) or as part of the application. There is a risk that the proposed testing schedule used to support the SLRA is not approved.

RESPONSE:

The staff agreed with this comment. No changes were made to the AMP because the comment did not propose any specific changes. The staff concluded that the subsequent license renewal (SLR) applicant can either receive prior approval of their surveillance capsule withdrawal schedule, which would be reflected in the description of the AMP for RPV material surveillance in the SLR application, or the issuance of a subsequently renewed license would confer approval of the schedule within the context of the acceptable AMP. There would be no need for approval of the capsule withdrawal schedule in a separate license amendment, unless the plant desires to change the withdrawal schedule after issuance of the subsequently renewed license.

Comment: **011**

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–1 Lines 10-11 - Program Description:

In the Program Description, the sentence beginning with "because of the resulting lead factors" could be misleading. Some capsule lead factors are less than one. Therefore, they may not receive equivalent neutron fluence before the location on the inner surface of the vessel that receives the highest fluence.

- Revise to say "Surveillance capsules with a lead factor greater than one receive equivalent neutron fluence exposures earlier than the inner surface of the reactor vessel."

RESPONSE:

The staff agreed with this comment. The staff amended the referenced sentence to state:

> "Because of the location of the capsules between the reactor core and the reactor vessel wall, surveillance capsules typically receive neutron fluence exposures that are higher than the inner surface of the reactor vessel."

The staff concluded that this modification reflects the reality that for some plants the surveillance capsules do not receive neutron fluence exposures that are higher than the peak fluence on the inner surface of the RPV.

Comment: **012**

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–1 lines 7, 10 et al Program Description/ Evaluation and Technical Basis

The program uses the terms "capsules" and "specimens." Capsules are housed in surveillance capsule specimen holders or baskets. The capsules contain the surveillance specimens.

- The usage of these terms should be reviewed to ensure their proper usage.

Source 018

RESPONSE:

The staff did not agree with this comment. No changes were made to the AMP based on this comment. The staff concluded that the use of specimens and capsules was appropriate.

Comment: 013

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–1, lines 15-28, Program Description

The second paragraph indicates that standby capsules needed for the Appendix H program should be reinserted so that appropriate lead factors are maintained. Lead factors are fixed based on geometry.

- This sentence should be revised to say "…these should be reinserted in a location with an appropriate lead factor such that test results will bound the desired operating period."

RESPONSE:

The staff agreed with this comment. The AMP was modified to state that "the surveillance capsule(s) should be reinserted, if necessary, in a location with an appropriate lead factor to ensure that the neutron fluence of the surveillance capsule and the test results will, at a minimum, bound the peak neutron fluence of interest projected to the end of the subsequent period of extended operation." The staff concluded that the modification was a correction to convey the intent of the lead factor for reinserted capsules.

Comment: 014

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–1, lines 35-37, Program Description

The program description refers to "…sufficient material data and dosimetry to (a) monitor irradiation embrittlement to neutron fluence greater than the projected fluence at the end of the subsequent period of extended operation,…" This sentence is more complex than necessary.

- It should be clarified to say "sufficient material data and dosimetry to (a) assess irradiation embrittlement at the end of the subsequent period of extended operation,…"

RESPONSE:

The staff did not agree with this comment. No changes were made to the AMP based on this comment. The staff noted that the comment was strictly editorial and did not propose any changes that would alter the context of the referenced AMP program description sentence. The staff concluded that the existing wording was adequate to convey the objective of the program, thus no change was necessary.

Comment: 015

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI. M31–1, Lines 38-40

GALL-SLR states “If surveillance capsules are not withdrawn during the subsequent period of extended operation, provisions are made to perform dosimetry monitoring.” Industry recommends that this statement be revised to state that the presence of an in-vessel standby capsule, coupled with use of an approved fluence prediction model consistent with RG 1.190 requirements, satisfies the need for dosimetry and fluence monitoring.

RESPONSE:

The staff partially agreed with this comment. The staff amended the program description in GALL-SLR Report AMP XI.M31, “Reactor Vessel Material Surveillance,” to include the following sentence:

> “An in-vessel standby capsule, or a standby capsule which has been retrieved from storage and reinserted, when coupled with the use of an NRC-approved methodology for determining neutron fluence consistent with Regulatory Guide (RG) 1.190, “Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence,” provides an acceptable means of dosimetry Monitoring.”

The staff agreed with the commenter to amend the referenced AMP program description to reflect that an in-vessel standby capsule, or a standby capsule, which has been retrieved from storage and reinserted, when coupled with the implementation of an NRC-approved neutron fluence methodology, provides an acceptable means of performing neutron dosimetry monitoring activities. The staff concluded that the use of an in-vessel capsule, whether it has been in the vessel, or has been reinserted for irradiation, provides an additional acceptable means to achieve these objectives.

Comment: 016

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI.M31-1, lines 41-42 And XI.M31-3, lines 2-3,

The measurements are specific to Charpy V-notch 30 ft-lb transition temperature and upper-shelf energy.

- Charpy is an indirect approximation of fracture toughness. Fracture toughness measurements provide the best understanding of the RPV integrity and embrittlement. If the utility wants to make the scientifically better measure (T_0 per ASTM E1921 or upper-shelf J-R curve per ASTM E1820), they should be allowed (in fact encouraged) to.

- Recommend that irradiated T_0 and upper-shelf J-R curve measurements can optionally be measured.

RESPONSE:

The staff did not agree with this comment.

No changes were recommended for the AMP based on this comment. The staff concluded that the AMP reflects the aspects of a current generic program that is considered adequate for monitoring neutron embrittlement of RPV materials and is consistent with NRC regulations. Although it may have technical merit, the use of irradiated T_0 and upper-shelf J-R curve measurements are acceptable only on a plant-specific basis, and typically would require exemptions from current regulatory provisions in 10 CFR Part 50, or the submittal of plant-specific alternatives that would require staff approval under the applicable existing 10 CFR Part 50 regulation for the applicable RPV neutron embrittlement TLAA.

Comment: 017

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–2, lines 8-10, Program Description

The program description refers to "the conversion of standby capsules into the Appendix H program…" Capsules can be incorporated into the program, but they can't literally be converted into a program.

- Simplify the sentence to say "Any changes to the capsule withdrawal schedule, including the extension of the surveillance program for the period of extended operation, must be approved…"

RESPONSE:

The staff agreed with this comment. The staff amended the referenced sentence to state:

> "Any changes to the surveillance capsule withdrawal schedule, including the incorporation and change of status of standby capsules to capsules scheduled for withdrawal and testing . . . must be approved by the NRC prior to implementation . . ."

The staff considers the proposed change of the referenced sentence to be editorial. The revised wording clarifies the criteria for using standby capsules in the AMP.

Comment: 018

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31–2 Line 20, Scope of Program

Currently, ASTM E185 and 10 CFR 50 Appendix H monitor embrittlement of a vessel that exceeds 10^{17} n/cm² via a surveillance program for materials that were predicted to be limiting at the time of vessel construction; it is not required to have the actual limiting materials in the surveillance program. The Scope statement here says "Materials originally monitored within the licensee's existing 10 CFR Part 50, Appendix H, materials surveillance program will continue to serve as the basis for the reactor vessel surveillance aging management program (AMP) unless safety considerations for the term of the subsequent period of extended operation would require the monitoring of additional or alternative materials." Several comments:

- What are "safety considerations", how will they be determined, and when will they be determined? Could NRC Staff decide, after a plant enters SLR, that a material must be monitored in the surveillance program? It would not be possible to fabricate specimens, build and insert a capsule and achieve required fluence targets before the end of SLR in that case; would the plant have to shut down?

- No such safety considerations have ever been identified. It is inconceivable that monitoring a different or additional material would ever be necessary for safety reasons; current embrittlement trend correlations are adequate for predicting embrittlement behavior of all vessel materials. This provision for a possible need to monitor alternate materials is unnecessary and should be deleted.

RESPONSE:

The staff agreed with this comment. The revised sentence also incorporates the recommended change as proposed in Comment 018-019. The staff amended the referenced sentence to state:

> "Materials monitored within the licensee's existing, materials surveillance program typically continue to serve as the basis for the reactor vessel surveillance aging management program (AMP)."

The staff does not envision a case where monitoring of other materials would be feasible or necessary.

<u>**Comment**: **019**</u>

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31-2, line 28, Scope of Program

- A utility may choose to monitor materials which are limiting regarding RPV operation or safety. These may or may not be materials which were originally included in the program.

- Recommend replacing "will" with "typically."

RESPONSE:

The staff agreed with this comment. Consistent with the previous basis for resolving Comment 018-018, the staff modified the last sentence in first paragraph of the AMP's Scope of Program element to state:

"Materials monitored within the licensee's existing materials surveillance program typically continue to serve as the basis for the reactor vessel surveillance aging management program (AMP)."

Comment: 020

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31-2, line 25, Scope of Program

10^{17} n/cm^2 comes from Appendix H where it says that RVs with this fluence need a surveillance program. This limit has been extended as a default value for sufficient fluence for which embrittlement effects must be considered.

- This fluence is a good approximate limit below which significant embrittlement is not expected.
- TLR-RES/DE/CIB-2013-01 offers an alternate limit: "the mean value of ΔT30 estimated using an ETC [embrittlement trend curve] acceptable to the staff is less than 25°F at EOL. The estimate of ΔT30 at EOL shall be made using best-estimate chemistry values." This is also a good approximate limit commensurate with the magnitude in the uncertainty of the embrittlement prediction models.
- Recommend inserting "or as recommended in TLR-RES/DE/CIB-2013-01."

RESPONSE:

The staff did not agree with this comment. Therefore, the staff did not amend the referenced Scope of Program element sentence in accordance with the change proposed in the comment. The staff did make an editorial change to the referenced sentence not related to the comment. The amended Scope of Program element sentence now reads:

> *"Materials with a projected neutron fluence greater than 10^{17} n/cm^2 (E > 1 MeV) at the end of the license period (for example, the subsequent period of extended operation) are considered to experience sufficient neutron damage to be included in the beltline."*

The comment provides the commenter's perspective that the AMP's Scope of Program element should be modified to allow use of the NRC Office of Research (RES) Report TLR-RES/DE/CIB-2013-01, so that an applicant could use the ΔT_{30} parameter as an alternative threshold criterion for establishing when a ferritic RPV component would need to be included within the scope of the applicant's RPV material surveillance program.

The staff did not agree that the use and reference of a ΔT_{30} parameter, as referenced in RES Report TLR-RES/DE/CIB-2013-01, serves as an acceptable basis for establishing when a licensed owner of a U.S. light-water reactor would need to design, establish, and implement a RPV material surveillance program in the current licensing basis (CLB) for its facility, or for determining which of the specific RPV components made from ferritic steel materials would need to be included within the scope of the program. This type of alternative basis would need to be proposed as a regulatory exemption to the requirements in 10 CFR Part 50, Appendix H, under the requirements in 10 CFR 50.60(b) and reviewed for acceptability in accordance with the exemption request processing requirements in 10 CFR 50.12.

Comment: **021**

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–2, lines 38-39, Parameters Monitored or Inspected

This program element says the program monitors reduction of fracture toughness. Reduction of fracture toughness can be assessed, but cannot be monitored. The actual parameters monitored in this program are the parameters monitored during the testing of the surveillance specimens and the neutron dosimetry materials. We believe that would be parameters measured in the Charpy testing and the properties of the dosimetry used to determine fluence. Calculations of capsule and vessel wall fluence, while important, do not constitute parameters monitored in the program. This and much of the other discussion has nothing to do with parameters monitored.

RESPONSE:

The staff did not agree with this comment. The staff did not make any changes to GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance," based on this comment.

Section I of 10 CFR Part 50, Appendix H, states that the reactor vessel materials surveillance program:

> monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region of light water nuclear power reactors which result from exposure of these materials to neutron irradiation and the thermal environment

Furthermore, in SRP-SLR, Appendix A.1, Section A.1.1.1, the staff has redefined that "condition monitoring programs" may include both monitoring programs that inspect for the presence and extent of aging effects and those that utilize material testing in order to monitor for potential changes in a component's or structure's material condition. Thus, contrary to the statements made in the comment, use of the word "monitoring" is appropriate for the intended purpose in the referenced sentence.

Comment: **022**

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31-2 and M31-5,

Many plants will need to build reconstituted capsules for SLR to conform to GALL-SLR. The draft GALL-SLR provides no guidance for the material specimen contents of the reconstituted capsules.

- It is recommended that the reconstituted capsules include base metal and weld materials and that HAZ specimens should not be required.

RESPONSE:

The staff did not agree with this comment.

The staff did not make any changes to GALL-SLR Report AMP XI.M31, “Reactor Vessel Material Surveillance,” based on this comment.

The scope of AMP XI.M31 identifies that the use of capsules containing reconstituted surveillance test specimens is one possibility for SLR applicants. However, guidance for the use of RPV surveillance capsules that contain reconstituted specimens. Therefore, there is no generic activity that would be appropriate to identify in the AMP. SLR applicants may use a plant-specific basis to propose the use of reconstituted specimens in their subsequent license renewal application (SLRA) and a plant-specific evaluation would ensue. Note that the current licensing basis provisions for the plant's surveillance program would still hold for SLR, such as the inclusion of heat-affected-zone specimens in the surveillance capsules, unless an exemption is approved for the plant.

Comment: 023

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI. M31–3, lines 28-30, Detection of Aging Effects

The first paragraph refers to Element 3 as describing methods used to monitor irradiation embrittlement. This seems inappropriate as Detection of Aging Effects seems the correct program element to describe methods used for monitoring in the AMP.

RESPONSE:

The comment states that the reference to Program Element 3 in the referenced sentence may not be appropriate for inclusion in the sentence and recommended that the reference to Program Element 3 be deleted from scope of the referenced program element sentence.

The reference to Program Element 3 in the cited sentence was made to reference some of the statements made in the Parameters Monitored or Inspected, program element of the AMP regarding implementation of 10 CFR Part 50, Appendix H reporting requirements. The staff did not include the parenthetical Element 3 reference in the sentence in order to differentiate the parameters monitored by the AMP from the methods that would be used to monitor those programmatic parameters. However, inclusion of the parenthetical reference to Element 3 in the referenced Detection of Aging Effects sentence does not affect how an applicant would apply either the Parameters Monitored or Inspected, or the Detection of Aging Effects program element criteria in AMP XI.M31.

Comment: 024

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–4, lines 1-7, Detection of Aging Effects

Third paragraph indicates that a plant participating in an ISP is required by Appendix H to institute "a supplemental neutron monitoring program." It is not clear from the words in Appendix H that a supplemental neutron monitoring program is required in order to have an adequate dosimetry program. It would be good to include a definition of "supplemental neutron monitoring program" or to provide a reference to a regulatory standard or guideline that defines this.

RESPONSE:

The staff agreed with this comment. The staff made appropriate changes to the Detection of Aging Effects, program element in GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance," based on this comment.

The staff agreed that the regulation in 10 CFR Part 50, Appendix H, does not include any criteria for licensees to design and implement supplemental neutron fluence dosimetry programs if the CLB for the facility were to be approved for implementation of an NRC-approved ISP for the facility. Therefore, the staff revised the second sentence of third paragraph in the Detection of Aging Effects, of the draft AMP to state:

> "The plant implements dosimetry monitoring as required by the approved ISP to meet the provision of 10 CFR Part 50, Appendix H, Paragraph III.C.1.b, that each reactor in an ISP has an adequate dosimetry program."

The revised sentence has been editorially relocated as the last sentence in the second paragraph of the Detection of Aging Effects program element in AMP XI.M31.

Comment: 025

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31-2, lines 8-13, Detection of Aging Effects

Recommend a statement be added regarding periodic monitoring.

By design, the surveillance capsule dosimetry is withdrawn infrequently. Periodic measurements will help to confirm continued accuracy of the neutron fluence calculations. ASTM E2956-14 "Standard Guide for Monitoring the Neutron Exposure of LWR Reactor Pressure Vessels" should be referenced.

Source 018

RESPONSE:

The staff did not agree with this comment or the commenter's recommendation to add an ASTM E2956-14 related sentence to the Detection of Aging Effects program element in GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance."

The staff acknowledges that ASTM's defined practice in Standard Practice E2956-14 may constitute an acceptable basis for performing dosimetry monitoring activities. However, the current regulation in 10 CFR Part 50, Appendix H, "Reactor Vessel Materials Surveillance Program Requirements," does not reference use of ASTM E2956-14 and the standard has yet to be endorsed for use by the NRC. Instead, the regulation in 10 CFR Part 50, Appendix H, endorses use of the program in the ASTM Standard Practice E185 edition of record for the facility (which may be the 1973, 1979, or 1982 edition of ASTM E185 for the CLB). ASTM E185 in turn references use of ASTM Standard Practice E482 as the basis for performing dosimetry-related measurements, calculations, or estimates. Thus, any proposal to use ASTM E2956-14 as the basis for performing dosimetry monitoring activities will need to be justified as an exception to the Detection of Aging Effects program element in AMP XI.M31, and identified by the applicant in its SLRA.

<u>**Comment**: **026**</u>

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI.M31-3, lines 30-31, Detection of Aging Effects,

- With approval of the first license renewal, few plants retain the original withdrawal schedule.
- Recommend rewording of sentence as follows: "The current withdrawal should be re-evaluated and standby capsules may need to be converted to testing program capsules within a withdrawal schedule that covers the subsequent period of extended operation."

RESPONSE:

The staff partially agreed with this comment. To address this comment and other comments received on GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance," the staff added the following sentence to the end of the first paragraph in the Detection of Aging Effects, program element of the AMP:

> "Alternatively, this program can propose implementation of in-vessel irradiation of capsule(s) with reconstituted specimens from previously tested capsules and appropriate neutron fluence monitoring."

The staff concluded that the proposed change to the referenced sentence was not needed from a sentence context perspective and therefore did not implement the recommended change in the manner proposed. The additional sentence addresses a potential contingency that may be used if the facility does not have any standby capsules available for irradiation and testing.

Comment: 027

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI.M31-4, lines 31-35, re “peak reactor vessel wall neutron fluence”

Peak wall fluence is not relevant for BWRs since they do not need to comply with the PTS Rule. The 1/4T fluence is the location of concern for BWRs.

- The SLR capsule fluence specification for BWRs should be based on 1/4T fluence, not peak RPV wall fluence.

RESPONSE:

The staff agreed with this comment. The staff amended the referenced sentence to state:

> “The plant-specific surveillance program or ISP has at least one capsule that has attained or will attain neutron fluence between one and two times the peak reactor vessel wall neutron fluence of interest at the end of the subsequent period of extended operation.”

The staff agreed that fluence exposures of surveillance capsules removed and tested by the program should be aligned to the specific type of fluence parameter that is assessed in the specific TLAAs of interest, as defined in SRP-SLR Section 4.2, and performed in accordance with the licensing basis for the facility.

Comment: 028

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI.M31-4, Lines 40-45,

For an already withdrawn capsule, recommending reporting of results per 10CFR50 Appendix H has been interpreted to require reporting within 1 year of renewed license

- The data is not needed or useful as long as the RPV fluence has not exceeded a previous capsule measurement.
- Recommend changing to allow reporting any time prior to entering SLR operating period as long as previous capsule results have already been reported for a fluence greater than 60 year RPV fluence.

RESPONSE:

The staff did not agree with this comment. The staff amended the referenced sentence in the second paragraph of the Monitoring and Trending element in GALL-SLR Report AMP XI.M31, “Reactor Vessel Material Surveillance,” to state:

> "If an existing standby capsule that has been previously withdrawn from the reactor vessel is used for testing to meet the neutron fluence criterion for the subsequent period of extended operation and the capsule does not require additional irradiation, then that (formerly standby) capsule is incorporated into the surveillance capsule withdrawal schedule of the Reactor Vessel Material Surveillance program upon receipt of the subsequently renewed license, and reporting of the test results is consistent with 10 CFR Part 50, Appendix H, with the "withdrawal date" of the capsule considered to be no later than the date of the subsequently renewed license."

The staff concluded that, since the purpose of the RPV material surveillance program is to provide a prospective look on the embrittlement trend for the RPV, the prompt testing and reporting of the results from a capsule, which does not require additional radiation exposure, as described in Appendix H to 10 CFR part 50, is appropriate to ensure use of all reasonably available information for the plant, as clearly intended by the Appendix H reporting requirement. For the case cited by the commenter, the addition of the data from a former standby capsule may indicate a trend in the behavior of the RPV material that should be addressed promptly by the plant.

Comment: 029

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–1, Lines 21-24,

These lines state that if standby capsules are going to be included and are not in the vessel, they shall be reinserted. However, on page XI.M31-4 (lines 40-45) it states that if a capsule has already been pulled and has enough fluence it can be tested without inserting it back into the vessel.

- These statements seem to conflict.

RESPONSE:

The staff agreed with this comment. An identical comment was made in Comment 025-010. The staff made appropriate changes to the program description and Monitoring and Trending program element in GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance," to address these comments.

To correct any potential misinterpretations by prospective applicants, the staff amended the fourth sentence in the second paragraph of the program description in AMP XI.M31 to indicate that the capsules "*should be reinserted, as necessary…* The sentence now states:

> "If standby capsule(s) will be incorporated into the Reactor Vessel Material Surveillance program for withdrawal and testing to address the subsequent period of extended operation and the capsule(s) has already been withdrawn from the reactor vessel and placed in storage, the surveillance capsule(s) should be reinserted, if necessary, in a location with an appropriate lead factor to ensure that the neutron fluence of the surveillance capsule and the test results will, at a minimum, bound the peak neutron fluence of interest projected to the end of the subsequent period of extended operation."

The staff also amended the second paragraph in the draft Monitoring and Trending program element to provide more detailed guidance for the staff expectations for supplemental (standby) capsule removal and specimen testing expectations for the subsequent period of extended operation. The revised Monitoring and Trending paragraph now reads in part, as follows:

> "The plant-specific surveillance program or ISP has at least one capsule that has attained or will attain neutron fluence between one and two times the peak reactor vessel wall neutron fluence of interest at the end of the subsequent period of extended operation. If a capsule meeting this neutron fluence criterion has not been tested previously, then the program includes withdrawal and testing (or alternatively the retrieval from storage, reinsertion for additional neutron fluence accumulation, if necessary, and testing) of one capsule addressing the subsequent period of extended operation. (If a surveillance capsule was previously identified for withdrawal and testing to address the initial period of extended operation, it is not acceptable to redirect or postpone the withdrawal and testing of that capsule to achieve a higher neutron fluence that meets the neutron fluence criterion for the subsequent period of extended operation.) The program withdraws, and subsequently tests, the capsule(s) at an outage in which the capsule receives a neutron fluence of between one and one and two times the peak reactor vessel neutron fluence of interest at the end of the subsequent period of extended operation. Test results from this capsule are reported as described in 10 CFR Part 50, Appendix H. If an existing standby capsule that has been previously withdrawn from the reactor vessel is used for testing to meet the neutron fluence criterion for the subsequent period of extended operation and the capsule does not require additional irradiation, then that (formerly standby) capsule is incorporated into the surveillance capsule withdrawal schedule of the Reactor Vessel Material Surveillance program upon receipt of the subsequently renewed license, and reporting of the test results is consistent with 10 CFR Part 50, Appendix H, with the "withdrawal date" of the capsule considered to be no later than the date of the subsequently renewed license.

<u>Comment: 030</u>

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–5 Element 5, lines 32-37

GALL-SLR: "If the plant uses an embrittlement trend curve (ETC) to determine embrittlement (such as those of RG 1.99, Rev. 2, 10 CFR 50.61, and 10 CFR 50.61a), the program ensures that the operating conditions for the reactor vessel beltline are within the applicability limits of the embrittlement trend curve with respect to parameters such as irradiation temperature, neutron fluence, and flux, or provides technical justification for exceeding these applicability limits."

- This provision modifies the requirements of 10 CFR 50.61 and should be deleted. 10 CFR 50.61 specifies the ETC to be used without consideration of several of the parameters discussed above. It is inappropriate for this guidance to modify the requirements given in 10 CFR 50.61.

RESPONSE:

The staff partially agreed with this comment.

The staff made appropriate changes to the program description and Monitoring and Trending and Parameters Monitored or Inspected program elements in GALL-SLR Report AMP XI.M31, “Reactor Vessel Material Surveillance,” to address the comment.

An identical comment was made in Comment 025-011. The staff did not agree with the comment statements that the staff was changing the requirements in the 10 CFR 50.61 regulation, but did agree that the related statements in the referenced sentence, and even in the last two paragraphs of the Monitoring and Trending program element for AMP XI.M31, were related to evaluations of related RPV neutron irradiation embrittlement TLAAs, and not to any programmatic monitoring criteria for implementing the AMP.

The staff deleted the last two paragraphs of the Monitoring and Trending program element from the final version of this program element. Instead, the staff moved any needed cross-reference statements relating AMP program element criteria to those for performing related RPV neutron irradiation embrittlement TLAA calculations into the Parameters Monitored or Inspected program element. The Parameters Monitored or Inspected program element has been modified (in the second paragraph of the “Parameters Monitored or Inspected program element of the AMP) to include the following statement:

> “The peak reactor vessel neutron fluence of interest at the end of the subsequent period of extended operation should address the TLAAs as described in the following sections of the SRP-SLR, as applicable: Sections 4.2.2.1.2 (Upper-Shelf Energy), 4.2.3.1.3 (Pressurized Thermal Shock) and 4.2.3.1.4 (Pressure-Temperature Limits) for PWRs; and Sections 4.2.2.1.2 (Upper-Shelf Energy), 4.2.3.1.4 (Pressure Temperature Limits), 4.2.3.1.5 (Elimination of Boiling Water Reactor Circumferential Weld Inspection) and 4.2.3.1.6 (Boiling Water Reactor Axial Welds) for BWRs.”

Comment: 031

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI.M31-5, Element 5

The GALL-SLR would require a program to have both an SLR capsule and a contingency capsule (in case the SLR capsule test results are not valid). This results in some plants having to add two capsules for SLR.

- This is an onerous requirement with negligible safety benefit, especially for plants that have already tested all capsules and will need to build new capsules. Experience does not support the proposed requirement for a contingency capsule.
- Recommend adding “, if available,” after “additional capsules”.

RESPONSE:

The staff partially agreed with the comment.

The staff deleted the third paragraph in the Monitoring and Trending program element and updated the second paragraph to provide better guidance for the staff expectations for performing surveillance capsule removals and surveillance capsule specimen testing during a proposed subsequent period of extended operation. The changes to the second paragraph of the AMP's Monitoring and Trending program element have been summarized in the staff's basis for resolving the previous Comment 018-029.

Comment: 032

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–5 Lines 23

- No criteria are provided.
- Recommend adding at the end "to re-establish the program."

RESPONSE:

The staff did not agree with this comment.

No changes were made to the AMP based on this comment. The staff concluded that the recommended wording neither enhanced nor changed the meaning of the text.

Comment: 033

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–5 Lines 27 and 33,

- Use of "latest version" will ensure the language does not become outdated should RG 1.99 be revised.

- Recommend changing "Rev. 2" to "latest version".

RESPONSE:

The staff did not agree with this comment that the AMP should reference the latest version of the RG 1.99 guidelines because the staff needs to reference the latest staff-approved version of the guidelines, not future versions of the guidelines that have yet to be developed or formally issued by the NRC. However, based on the resolution of the previous Comment 018-030, the paragraphs containing these sentences have been deleted from the final version of the Monitoring and Trending program element.

Comment: 034

Description of Change/Comment and Justification

(Note; "XI.M31-x" refers to a page number in GALL-SLR)

XI. M31–6 Lines 34-36,

Source 018

This part states “This program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience, as discussed in Appendix B of the GALL-SLR Report.”

- COMMENT: What constitutes a “systematic and ongoing review”? This appears vague and not defined.

RESPONSE:

The staff did not agree with this comment.

The comment references the sentence that forms the last paragraph of the Operating Experience program element in GALL-SLR Report AMP XI.M31, “Reactor Vessel Material Surveillance.” The commenter questioned what type of activities would form the basis for performing a systematic and ongoing review of operating experience (OE).

Specifically, the staff has updated the SRP-SLR appendices to update the OE review criteria in Section A.1.2.3.10 that may be applied to those AMPs that will be defined in an SLRA. In addition, the new criteria in SRP-SLR Appendix A.4, provide the staff’s new criteria for performing systematic and ongoing reviews of OE. The staff also incorporated similar criteria for performing ongoing reviews of OE into GALL-SLR Report Appendix B, “Operating Experience for Aging Management Programs.” To be consistent with the new guidelines in Appendix B, the staff has revised the referenced Operating Experience program element sentence to state:

> “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 such that the effectiveness of the AMP is evaluated consistent with the discussion in Appendix B of the GALL-SLR Report.”

Comment: 035

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI. M31–6, lines 1-17, Corrective Actions

This program element begins with discussion of results that do not meet the acceptance criteria. However, according to the acceptance criteria program element, there are no specific acceptance criteria that apply to the surveillance data. Corrective actions and parameters monitored and inspected discuss operating temperature, but acceptance criteria don’t address operating temperature.

- There should be a clear relationship between parameters monitored, monitoring method, and acceptance criteria.

AMP Mark-up: Corrective Actions

7. Corrective Actions:

~~*Results that do not meet the acceptance criteria*~~ Nonconforming program activities or results are addressed as conditions adverse to quality or significant conditions adverse to quality under those specific 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 of the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report describes how an applicant may apply its 10 CFR Part 50, Appendix B, QA program to fulfill the corrective actions element of this AMP for both safety-related and nonsafety related structures and components (SCs) within the scope of this program.

Since the data from this program are used for reactor vessel embrittlement projections to comply with regulations (e.g., 10 CFR Part 50, Appendix G, requirements, and 10 CFR 50.61 or 10 CFR 50.61a limits) through the ~~*subsequent*~~ period of extended operation, corrective actions would be necessary if these requirements are not satisfied, or if this program fails to comply with Appendix H of 10 CFR Part 50. If plant operating characteristics exceed the operating restrictions identified previously, such as a lower reactor vessel operating temperature or a higher fluence, this program provides that the impact of actual plant operation characteristics on the extent of reactor vessel embrittlement is evaluated, and the NRC is notified.

RESPONSE:

The staff partially agreed with this comment. The staff made appropriate changes to the Corrective Actions program element in GALL-SLR Report AMP XI.M31, “Reactor Vessel Material Surveillance,” based on this comment.

The comment references and proposed minor changes to the sentences in the first two paragraphs of the Corrective Actions program element. The staff decided against implementing the exact changes proposed by the commenter, but did implement a change to the first sentence of the first paragraph of the Corrective Actions program element in AMP XI.M31 that removes any references to “conditions adverse to quality or “significant conditions adverse to quality” in the sentence. The staff deleted the previous references to “conditions adverse to quality or “significant conditions adverse to quality’ because these types of adverse conditions should be well defined in an applicant’s 10 CFR Part 50, Appendix B, Quality Assurance Program. Therefore, the first sentence in the first paragraph of the Corrective Actions program element in GALL-SLR AMP XI.M31 has been updated to state:

> “Results that do not meet the acceptance criteria are addressed in the applicant’s corrective action program under those specific portions of the quality assurance (QA) program that are used to meet Criterion XVI, “Corrective Action,” of 10 CFR Part 50, Appendix B.

<u>Comment</u>: <u>036</u>

Description of Change/Comment and Justification

(Note; “XI.M31-x” refers to a page number in GALL-SLR)

XI. M31–(various) Various places referring to ISP(s)

The requirements for Integrated Surveillance Programs (ISPs) outlined in XI.M31 are confusing. If an ISP has been reviewed and approved for the Subsequent License Renewal period per 10 CFR 50 Appendix H, and a plant is licensed to participate in that ISP, then guidance in a regulatory guide is not relevant. Therefore, “ISP” should be deleted from the following sentence under “Monitoring and Trending”.

- “The plant-specific surveillance program ~~or ISP~~ has at least one capsule that will attain projected neutron fluence equal to or exceeding the peak reactor vessel wall neutron fluence at the end of the subsequent period of extended operation.”

RESPONSE:

The staff did not agree with this comment. The staff did not make any changes to the AMP based on this comment.

The staff agreed that NRC-approved RPV ISPs are driven by the requirements for ISPs in 10 CFR Part 50, Appendix H and not the regulatory criteria and position in RG 1.99, Revision 2. However, this does not form a valid basis for deleting the reference of ISPs from the scope of sentences in GALL-SLR AMP XI.M31, “Reactor Vessel Material Surveillance,” that make references to ISPs. Specifically, to date, the staff has only approved two types of ISPs: (a) the BWRVIP-defined ISP for BWR light-water reactor designs, and (b) the Babcock and Wilcox (B&W) ISP for PWR light-water reactors whose RPVs were designed and fabricated by the B&W company (now, AREVA). Because the B&W ISP is designed to remove capsules from all light-water reactors within the scope of the ISP and to share the surveillance data between the owners of the reactors, the statement that the program “*has at least one capsule that will attain projected neutron fluence equal to or exceeding the peak reactor vessel wall neutron fluence at the end of the subsequent period of extended operation”* still applies and is valid for these types of ISPs.

For the BWRVIP-defined ISP, the program is based on a methodology that utilizes the capsule data from only a few BWR light-water reactors or research reactors on behalf of the RPVs in the population of BWR light-water reactors in the U.S. However, the current BWRVIP-defined ISP is based on program methodology that only covers plant operations through a cumulative 60-year licensed service life, and the ISP needs to be updated to cover additional ISP-defined capsule withdrawal criteria in support of plant operations during a proposed subsequent period of operation. Thus, the statement in question is valid and applies to these types of ISPs as well. Therefore, the staff did not find it appropriate to amend the referenced sentences as proposed by the commenter.

Source 019: NEI Attachment 6—Structural Comments

Comment: 001

Location: SLR-SRP Table 3.5-1

Description of Change:

As written, four (4) new Plant Specific AMPs required in SLR GALL for freeze-thaw, leaching and carbonation, and reaction with aggregates mechanisms for inaccessible concrete, and increased temperatures for concrete. IWL and SMP AMPs are adequate for these aging effects.

Justification for Change:

As stated below Plant specific evaluations including, where required, any additional program activities, should be included as part of the existing applicable AMP (i.e. XI.S2 or XI.S6) instead of creating a separate program. No OE justifies separate Plant Specific AMPs for inaccessible areas for these mechanisms and no OE justifies excavation and examination of the outside concrete wall surfaces for mechanisms such as freeze-thaw, leaching and carbonation, or reaction with aggregates, or high interior surface concrete temperatures.

We are unclear on acceptable options for such “Plant Specific AMPs” and this results in regulatory uncertainty.

RESPONSE:

The staff partially agreed with this comment and changes to the guidance documents have been made.

See the responses to the comments listed below for the changes to the guidance documents, and additional technical basis for the changes, for the listed material, environment, and aging effect program combination:

- Comment 019-002–Reduction of strength and modulus of elasticity of concrete due to elevated temperatures
- Comment 019-003–Loss of material and cracking due to freeze thaw in inaccessible concrete
- Comment 019-004–Cracking due to expansion from reaction with aggregates in inaccessible concrete
- Comment 019-005–Increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation in inaccessible concrete

In general, the staff clarifies that while the “aging effect” noted in the comment may or may not be covered for accessible areas under the scope of an existing aging management program (AMP), the existing AMP is not specifically called out in the aging management review (AMR) items with recommended further evaluation because the existing Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report AMP will not identify the aging effect (e.g., reduction of strength and modulus due to elevated temperature) and/or does not completely or adequately address the material, environment, and aging effect program combination for the component; and, therefore may need a plant-specific AMP based on the further evaluation. The term “plant-specific AMP” in the GALL-SLR Report and Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) is intended to mean a new plant-specific AMP or a plant-specific enhancement to the applicable existing programs to address these AMR items.

Comment: 002

Location: SLR-SRP Table 3.5-1 item 3

Description of Change:

Revise the SRP Table 1’s and GALL AMR line items to evaluate concrete for reduction of strength and modulus of elasticity due to elevated temperature with AMP XI.S2, “ASME Section XI, Subsection IWL,” and/or AMP XI.S6, “Structures Monitoring” instead of a Plant Specific AMP. (See markup in Attachment 1)

Justification for Change:

Plant specific evaluations, when required, should be included as part of the applicable AMP (XI.S2 or XI.S6) instead of creating a separate program. The components in question would remain within the scope of the original AMP for managing aging effects outside of those requiring plant specific evaluations, so additional or modified inspection activities would likely be performed in conjunction with normal examinations. Recognizing this in the SRP, AMRs, and AMPs would provide the same enhanced inspections while minimizing duplications and reducing the need to address inconsistencies with GALL E Notes.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made.

The staff did not intend applicants to be forced to create new plant-specific AMPs, if appropriate. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 was revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary. The wording in the associated GALL-SLR Report AMR items was revised to clearly note that a plant-specific AMP is to be evaluated.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” A plant-specific AMP should be evaluated if the temperature limits are exceeded. The further evaluation section (3.5.2.2.1.2) makes it clear that a plant-specific AMP is only necessary if the temperature limits are exceeded. Higher temperatures may be allowed without a plant-specific AMP 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.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the subsequent license renewal application (SLRA).

Comment: 003

Description of Change:

Revise the SRP Table 1’s and GALL AMR line items to evaluate concrete for loss of material (spalling, scaling) and cracking due to freeze-thaw with AMP XI.S2, “ASME Section XI, Subsection IWL,” and/or AMP XI.S6, “Structures Monitoring” instead of Plant Specific AMP. (See markup in Attachment 1)

Justification for Change:

See Justification for SLR-SRP Table 3.5-1 item 3 above.

Generic Comment for below grade Freeze-Thaw: There is no operating experience which would indicate that freeze thaw damage is a significant concern for inaccessible below grade concrete at nuclear power plants. Accessible concrete just above grade, or at other above grade locations, subject to wetting and temperatures below freezing should see significantly more freeze-thaw cycles than below grade concrete and therefore should be considered as a leading indicator of the condition below grade concrete for this mechanism. Additionally, the soil / backfill will act as an insulating moderating influence to reduce and limit the number of cycles just below grade compared to those experienced above grade, such that, little to no freeze thaw damage will take place beyond several inches just below the surface of the soil. Uninsulated reinforced concrete at a nuclear plant would have a thermal gradient from about 75°F inside the power plant to whatever equilibrium temperature is reached on the outside skin subject to some insulating properties of unsaturated soil/backfill. The SRP 3.5.3.2.1.7 paragraph includes an appropriate statement indicating that absence of freeze-thaw damage in accessible concrete should preclude the need for a plant specific program for inaccessible concrete. This accessible concrete threshold condition should be more widely applied regardless of the concrete air content and should be applied as a threshold for plant specific evaluations and any potential plant specific additions to existing aging management programs. In any case, examination and assessment of accessible concrete using the existing AMP is sufficient basis to also address inaccessible concrete.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 was revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” A plant-specific AMP should be evaluated if plants are located in moderate to severe weathering conditions. The further evaluation Section 3.5.3.2.1.7 makes it clear that a plant-specific AMP is only necessary if plants in moderate to severe weathering conditions do not have acceptable concrete air content or accessible concrete areas show freeze-thaw degradations.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 004

Location: SLR-SRP Table 3.5-1 item 12

Description of Change:

Revise the SRP Table 1's and GALL AMR line items to evaluate concrete for cracking due to expansion from reaction with aggregates with AMP XI.S2, "ASME Section XI, Subsection IWL," and/or AMP XI.S6, "Structures Monitoring" instead of Plant Specific AMP.

Justification for Change:

See Justification for SLR-SRP Table 3.5-1 item 3 above.

Generic Comment for cracking due to reaction with aggregates: Considering SLR plants are over 40 years of age and AAR, if potentially significant, would manifest significant concrete growth e.g., reduced seismic gaps, movement/changes at doors/penetrations, and additionally any such reactions should be nearly complete/complete well before the start of the second license renewal period of extended operation. Consider possible alternatives such as one time inspections/evaluations. For example if a petrographic examination finds that Akali-Silica Reaction is present but limited such that only a small percentage of the fine aggregate is reactive; it is possible that there will be no concrete damage, no resultant cracking, no growth or expansion, no effect on the physical properties of the concrete, and therefore there will be no potential for structurally significant degradation and no potential adverse effect on the intended function of the structure. Operating Experience for the only nuclear plant with potentially significant ASR identified in NRC Information Notice 2011-20 has performed examinations and evaluations with information obtained from the accessible sides of the concrete and has not found it necessary or helpful to excavate and perform a plant specific inspection program of the inaccessible areas. In any case, examination and assessment of accessible concrete using the existing AMP is sufficient basis to also evaluate and address inaccessible concrete.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made.

The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 was revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” Although it is likely most aggregate reaction degradation would have occurred prior to the subsequent license renewal (SLR), it is not definite that it would have occurred, or been properly identified. The associated SRP-SLR further evaluation Section 3.5.3.2.1.8 makes it clear that a plant-specific AMP is only necessary if applicants have plant-specific operating experience that indicates aggregate reaction degradation. Without this, no additional plant-specific AMP is necessary.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA. The SRP-SLR indications were identified based on the point at which the staff believes further evaluation needs to be conducted. The staff intended for an appropriate engineering evaluation to be an acceptable portion of the further evaluation.

Comment: 005

Location: SLR-SRP Table 3.5-1 item 14

Description of Change:

Revise the SRP Table 1’s and GALL AMR line items to evaluate concrete for increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation with AMP XI.S2, “ASME Section XI, Subsection IWL,” and/or AMP XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

See Justification for SLR-SRP Table 3.5-1 item 3 above.

Generic comment regarding leaching and inaccessible areas: Operating experience has shown that leaching has not been a major or even a significant structural concern in NPP structures approaching 40 years of operation. GALL limits leaching to a water flowing environment and defines water flowing as flowing water that is continually refreshed. EPRI TR- 103842 rev. 1, section 4.1.2 states that leaching action of water can only occur if water passes through the concrete; water that merely passes over the surface of the concrete will not cause significant leaching. ACI 224.1R-07 para. 1.3.5 states that cracks transverse to reinforcement do not usually cause continuing corrosion of reinforcement, as the exposed portion of the bar at a crack acts as an anode, such that at early stages local corrosion occurs, however since oxygen and moisture is not supplied to the same or connected bars then the corrosion process is self-sealing.
ACI 349.3R-02 para 4.2.8 indicates leaching occurs at locations of high moisture penetration and flow, such as cracks, and cites research indicating leaching effect depth of 3 mm to 9 mm for increase in porosity. Based on the above, examination from the accessible side where water is infiltrating is sufficient to assess any potential concerns from leaching for both the accessible side and the inaccessible side of the concrete. In any case, examination and assessment of accessible concrete using the existing AMP is sufficient basis to also evaluate and address inaccessible concrete.

Source 019

RESPONSE:

The staff partially agreed with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” If significant leaching is observed, it is necessary to evaluate the condition further. This is explained in the SRP-SLR further evaluation Section 3.5.3.2.1.9, which notes that a plant-specific AMP may not be necessary if an evaluation determines that the observed leaching in accessible areas has no impact on the intended function of the structure.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

<u>Comment</u>: **<u>006</u>**

Location: SLR-SRP Table 3.5-1 item 42

Description of Change:

Revise the SRP Table 1’s and GALL AMR line items to evaluate concrete for loss of material (spalling, scaling) and cracking due to freeze-thaw with XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

Plant specific evaluations, when required, should be included as part of the applicable AMP (XI.S6) instead of creating a separate program. The components in question would remain within the scope of the original AMP for managing aging effects outside of those requiring plant specific evaluations, so additional or modified inspection activities would likely be performed in conjunction with normal examinations. Recognizing this in the SRP, AMRs, and AMPs would provide the same enhanced inspections while minimizing duplications and reducing the need to address inconsistencies with GALL E notes. See also above Generic Comments for the applicable mechanism.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” A plant-specific AMP should be evaluated if plants are located in areas with moderate to severe weathering conditions. The further evaluation Section 3.5.3.2.1.7, makes it clear that a plant-specific AMP is only necessary if plants in moderate to severe weathering conditions do not have acceptable concrete air content or accessible concrete areas show freeze-thaw degradations.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 007

Location: SLR-SRP Table 3.5-1 item 43

Description of Change:

Revise the SRP Table 1’s and GALL AMR line items to evaluate concrete for cracking due to expansion from reaction with aggregates with AMP XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

See Justification for SLR-SRP Table 3.5-1 item 42 above and generic comment on cracking due to expansion from reaction with aggregates.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMPXI.S6, “Structures Monitoring.” Although it is likely most aggregate reaction degradation would have occurred prior to SLR, it is not definite that it would have occurred, or have been properly identified. The associated SRP-SLR further evaluation Section 3.5.3.2.1.8, makes it clear that a plant-specific AMP is only necessary if applicants have plant-specific operating experience that indicates aggregate reaction degradation. Without this, no additional plant-specific AMP is necessary.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Source 019

Comment: 008

Location: SLR-SRP Table 3.5-1 item 47

Description of Change

Revise the SRP Table 1's and GALL AMR line items to evaluate concrete for increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation with AMP XI.S6, "Structures Monitoring" instead of Plant Specific AMP.

Justification for Change:

See Justification for SLR-SRP Table 3.5-1 item 42 and generic comment for this mechanism

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," or GALL-SLR Report AMP XI.S6, "Structures Monitoring." If significant leaching is observed, it is necessary to evaluate the condition further. This is explained in the SRP-SLR further evaluation Section 3.5.3.2.1.9, which notes that a plant-specific AMP may not be necessary if an evaluation determines that the observed leaching in accessible areas has no impact on the intended function of the structure.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 009

Location: SLR-SRP Table 3.5-1 item 48

Description of Change

Revise the SRP Table 1's and GALL AMR line items to evaluate concrete for reduction of strength and modulus of elasticity due to elevated temperature with AMP XI.S6, "Structures Monitoring" instead of Plant Specific AMP.

Justification for Change:

See Justification for SLR-SRP Table 3.5-1 item 42 above.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," or GALL-SLR Report, AMP XI.S6, "Structures Monitoring." A plant-specific AMP should be evaluated if the temperature limits are exceeded. The further evaluation Section 3.5.2.2.1.2, makes it clear that a plant-specific AMP is only necessary if the temperature limits are exceeded. Higher temperatures may be allowed without a plant-specific AMP 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.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 010

Location: SLR-SRP Table 3.5-1 item 49

Description of Change

Revise the SRP Table 1's and GALL AMR line items to evaluate concrete for loss of material (spalling, scaling) and cracking due to freeze-thaw with XI.S6, "Structures Monitoring" instead of Plant Specific AMP.

Justification for Change:

See Justification for SLR-SRP Table 3.5-1 item 42 above, and generic comment for this mechanism.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," or GALL-SLR Report AMP XI.S6, "Structures Monitoring." A plant-specific AMP should be evaluated if plants are located in areas with moderate to severe weathering conditions. The further evaluation Section 3.5.3.2.1.7, makes it clear that a plant-specific AMP is only necessary if plants in moderate to severe weathering conditions do not have acceptable concrete air content or accessible concrete areas show freeze-thaw degradations.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 011

Location: SLR-SRP Table 3.5-1 item 50

Description of Change

Revise the SRP Table 1's and GALL AMR line items to evaluate concrete for cracking due to expansion from reaction with aggregates with AMP XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

See Justification for SLR-SRP Table 3.5-1 item 42 above, and generic comment for this mechanism.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” Although it is likely most aggregate reaction degradation would have occurred prior to SLR, it is not definite that it would have occurred, or have been properly identified. The associated SRP-SLR further evaluation Section 3.5.3.2.1.8, makes it clear that a plant-specific AMP is only necessary if applicants have plant-specific operating experience that indicates aggregate reaction degradation. Without this, no additional plant-specific AMP is necessary.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

<u>Comment</u>: <u>012</u>

Location: SLR-SRP Table 3.5-1 item 51

Description of Change

Revise the SRP Table 1's and GALL AMR line items to evaluate concrete for increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation with AMP XI.S6, "Structures Monitoring" instead of Plant Specific AMP.

Justification for Change:

See Justification for SLR-SRP Table 3.5-1 item 42 above, and generic comment for this mechanism.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," or GALL-SLR Report AMP XI.S6, "Structures Monitoring". If significant leaching is observed, it is necessary to evaluate the condition further. This is explained in the SRP-SLR further evaluation Section 3.5.3.2.1.9, which notes that a plant-specific AMP may not be necessary if an evaluation determines that the observed leaching in accessible areas has no impact on the intended function of the structure.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

<u>Comment</u>: <u>013</u>

Location: SLR-GALL items

II.A1.CP-34
II.B1.2.CP-57
II.B2.2.CP-57
II.B3.1.CP-65
II.B3.2.CP-108

Source 019

Description of Change

Revise the GALL AMR line items to evaluate concrete for reduction of strength and modulus of elasticity due to elevated temperature with AMP XI.S2, “ASME Section XI, Subsection IWL,” and/or AMP XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

Plant specific evaluations, when required, should be included as part of the applicable AMP (XI.S2 or XI.S6) instead of creating a separate program. The components in question would remain within the scope of the original AMP for managing aging effects outside of those requiring plant specific evaluations, so additional or modified inspection activities would likely be performed in conjunction with normal examinations. Recognizing this in the SRP, AMRs, and AMPs would provide the same enhanced inspections while minimizing duplications and reducing the need to address inconsistencies with GALL (Note E).

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” A plant-specific AMP should be evaluated if the temperature limits are exceeded. The further evaluation Section 3.5.2.2.1.2, makes it clear that a plant-specific AMP is only necessary if the temperature limits are exceeded. Higher temperatures may be allowed without a plant-specific AMP 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.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 014

Location: SLR-GALL items

II.A1.CP-147
II.A2.CP-70
II.B3.2.CP-135

Description of Change

Revise the GALL AMR line items to evaluate concrete for loss of material (spalling, scaling) and cracking due to freeze-thaw with AMP XI.S2, “ASME Section XI, Subsection IWL,” and/or AMP XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

See SLR-GALL Chapter II #1

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” A plant-specific AMP should be evaluated if plants are located in areas with moderate to severe weathering conditions. The further evaluation Section 3.5.3.2.1.7, makes it clear that a plant-specific AMP is only necessary if plants in moderate to severe weathering conditions do not have acceptable concrete air content or accessible concrete areas show freeze-thaw degradations.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 015

Location: SLR-GALL items

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

Description of Change

Revise the GALL AMR line items to evaluate concrete for cracking due to expansion from reaction with aggregates with AMP XI.S2, “ASME Section XI, Subsection IWL,” and/or AMP XI.S6,”Structures Monitoring” instead of Plant Specific AMP.

Source 019

Justification for Change:

See SLR-GALL Chapter II #1

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6,”Structures Monitoring.” Although it is likely most aggregate reaction degradation would have occurred prior to SLR, it is not definite that it would have occurred, or have been properly identified. The associated SRP-SLR further evaluation Section 3.5.3.2.1.8, makes it clear that a plant-specific AMP is only necessary if applicants have plant-specific operating experience that indicates aggregate reaction degradation. Without this, no additional plant-specific AMP is necessary.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 016

Location

SLR-GALL items

II.A1.CP-102
II.A2.CP-53
II.B1.2.CP-110
II.B2.2.CP-110
II.B3.1.CP-53
II.B3.2.CP-122

Description of Change

Revise the GALL AMR line items to evaluate concrete for increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation with AMP XI.S2, “ASME Section XI, Subsection IWL,” and/or AMP XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

See SLR-GALL Chapter II #1

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2“ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” If significant leaching is observed, it is necessary to evaluate the condition further. This is explained in the SRP-SLR further evaluation Section 3.5.3.2.1.9, which notes that a plant-specific AMP may not be necessary if an evaluation determines that the observed leaching in accessible areas has no impact on the intended function of the structure.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 017

Location: GALL Ch. II and III

Description of Change

Not all previously identified line item needs were addressed i.e., concrete exposed to raw water, and SL 1 Coating exposed to treated water.

Justification for Change:

No line item exists for reinforced concrete material exposed to a raw water environment. This material and environment combination is applicable to intake structures/ultimate heat sinks, etc., at virtually all plants. Similarly, no line item exists for Service Level 1 Coatings exposed to a treated water environment; this material/environment combination is applicable to many containments and BWR tori and suppression pool components. NEI letter to NRC dated 08-06-14 contained this comment.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made.

“Environment” column of the GALL-SLR items listed below to “Any environment”

- III.A6.TP-36
- III.A6.TP-37
- III.A6.TP-38

Source 019

Revise the “Environment” column of the GALL-SLR items listed below as follows: “Air-indoor uncontrolled, treated water”

- II.A3.CP-152
- II.B4.CP-152
- III.A4.TP-301

Although no items exist for concrete exposed to raw water specifically, items do exist in GALL-SLR Chapter III, Table A6 that address concrete in “any environment,” or include flowing water in the possible environments. These items can be applied to concrete in raw water. The environment in several additional items has been updated to “any” to make this clear.

The staff agreed with this comment. It is correct that service Level 1 protective coatings may be exposed to treated water. Treated water will be added as an applicable environment to the protective coating items that currently exist in GALL-SLR.

Comment: 018

Location: GALL Ch II and III and Programs, various locations

Description of Change

Previously offered efficiency recommendations appear not to have been addressed. NEI letter attachment to NRC dated 08-06-14 recommended combining and simplifying/reducing the number of line items. It also recommended combining several programs such as Masonry Walls and RG 1.127 and Overhead Handling with the Structures Monitoring Program. In addition, the X.S1 AMP (…Tendon Prestress) could also logically be combined with the XI.S2 (IWL) AMP.

Justification for Change:

See NEI to NRC letter and attachments dated 08-06-14

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff combined or deleted items it felt were appropriate. Multiple SRP-SLR Table 3.5-1 items have been combined or deleted.

The staff felt it was appropriate to maintain the AMPs as they were in the original guidance documents. However, guidance was added to GALL-SLR Report AMP XI.S6, “Structures Monitoring,” that makes it clear GALL-SLR Report AMPs XI.S5, “Masonry Walls,” and GALL-SLR Report AMP XI.S7, “Inspection of Water-Control Structures Associated with Nuclear Power Plants,” can be included within AMP XI.S5 if all the attributes of those programs are captured.

Comment: 019

Location: SLR-GALL items

III.A1.TP-108
III.A2.TP-108
III.A3.TP-108

III.A5.TP-108
III.A7.TP-108
III.A8.TP-108
III.A9.TP-108

Description of Change

Revise the GALL AMR line items to evaluate concrete for loss of material (spalling, scaling) and cracking due to freeze-thaw with XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

Plant specific evaluations, when required, should be included as part of the applicable AMP (XI.S6) instead of creating a separate program. The components in question would remain within the scope of the original AMP for managing aging effects outside of those requiring plant specific evaluations, so additional or modified inspection activities would likely be performed in conjunction with normal examinations. Recognizing this in the SRP, AMRs, and AMPs would provide the same enhanced inspections while minimizing duplications and reducing the need to address inconsistencies with GALL (Note E).

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” A plant-specific AMP should be evaluated if plants are located in areas with moderate to severe weathering conditions. The further evaluation Section 3.5.3.2.1.7, makes it clear that a plant-specific AMP is only necessary if plants in moderate to severe weathering conditions do not have acceptable concrete air content or accessible concrete areas show freeze-thaw degradations.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 020

Location: SLR-GALL items

III.A1.TP-204
III.A2.TP-204
III.A3.TP-204
III.A4.TP-204
III.A5.TP-204

Source 019

III.A7.TP-204
III.A8.TP-204
III.A9.TP-204

Description of Change

Revise the GALL AMR line items to evaluate concrete for cracking due to expansion from reaction with aggregates with AMP XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

See SLR-GALL Chapter III #1

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” Although it is likely most aggregate reaction degradation would have occurred prior to SLR, it is not definite that it would have occurred, or have been properly identified. The associated SRP-SLR further evaluation Section 3.5.3.2.1.8, makes it clear that a plant-specific AMP is only necessary if applicants have plant-specific operating experience that indicates aggregate reaction degradation. Without this, no additional plant-specific AMP is necessary.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

<u>**Comment**: **021**</u>

Location: SLR-GALL items

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

Description of Change

Revise the GALL AMR line items to evaluate concrete for increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation with AMP XI.S6, "Structures Monitoring" instead of Plant Specific AMP.

Justification for Change:

See SLR-GALL Chapter III #1

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," or GALL-SLR Report AMP XI.S6, "Structures Monitoring." If significant leaching is observed, it is necessary to evaluate the condition further. This is explained in the SRP-SLR further evaluation Section 3.5.3.2.1.9, which notes that a plant-specific AMP may not be necessary if an evaluation determines that the observed leaching in accessible areas has no impact on the intended function of the structure.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 022

Location: SLR-GALL items

III.A1.TP-114
III.A2.TP-114
III.A3.TP-114
III.A4.TP-114
III.A5.TP-114

Description of Change

Revise the GALL AMR line items to evaluate concrete for reduction of strength and modulus of elasticity due to elevated temperature with AMP XI.S6, "Structures Monitoring" instead of Plant Specific AMP.

Justification for Change:

See SLR-GALL Chapter III #1

Source 019

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” A plant-specific AMP should be evaluated if the temperature limits are exceeded. The further evaluation Section 3.5.2.2.1.2, makes it clear that a plant-specific AMP is only necessary if the temperature limits are exceeded. Higher temperatures may be allowed without a plant-specific AMP 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.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 023

Location: SLR-GALL item III.A6.TP-110

Description of Change

Revise the SRP Table 1's and GALL AMR line item to evaluate concrete for loss of material (spalling, scaling) and cracking due to freeze-thaw with XI.S6, “Structures Monitoring” instead of Plant Specific AMP.

Justification for Change:

See SLR-GALL Chapter III #1

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, “ASME Section XI, Subsection IWL,” or GALL-SLR Report AMP XI.S6, “Structures Monitoring.” A plant-specific AMP should be evaluated if plants are located in areas with moderate to severe weathering conditions. The further evaluation Section 3.5.3.2.1.7, makes it clear that a plant-specific AMP is only necessary if plants in moderate to severe weathering conditions do not have acceptable concrete air content or accessible concrete areas show freeze-thaw degradations.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 024

Location: SLR-GALL item III.A6.TP-220

Description of Change

Revise the SRP Table 1's and GALL AMR line item to evaluate concrete for cracking due to expansion from reaction with aggregates with AMP XI.S6, "Structures Monitoring" instead of Plant Specific AMP.

Justification for Change:

See SLR-GALL Chapter III #1

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," or GALL-SLR Report AMP XI.S6, "Structures Monitoring." Although it is likely most aggregate reaction degradation would have occurred prior to SLR, it is not definite that it would have occurred, or have been properly identified. The associated SRP-SLR further evaluation Section 3.5.3.2.1.8, makes it clear that a plant-specific AMP is only necessary if applicants have plant-specific operating experience that indicates aggregate reaction degradation. Without this, no additional plant-specific AMP is necessary.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

<u>Comment</u>: <u>025</u>

Location: SLR-GALL item III.A6.TP-109

Description of Change

Revise the SRP Table 1's and GALL AMR line item to evaluate concrete for increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation with AMP XI.S6, "Structures Monitoring" instead of Plant Specific AMP.

Justification for Change:

See SLR-GALL Chapter III #1

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The staff did not intend for applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 will be revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and this aging effect should be addressed within GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," or GALL-SLR Report AMP XI.S6, "Structures Monitoring." If significant leaching is observed, it is necessary to evaluate the condition further. This is explained in the SRP-SLR further evaluation Section 3.5.3.2.1.9, which notes that a plant-specific AMP may not be necessary if an evaluation determines that the observed leaching in accessible areas has no impact on the intended function of the structure.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants always have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

<u>Comment</u>: <u>026</u>

Location: SLR-GALL item III.B1.1.TP-41

Description of Change

Line item III.B1.1.TP-41 should contain the same exclusionary note regarding ASTM A325, F1852, and ASTM A490 bolts as line item III.A3.TP-300 and line item III.B2.TP-300.

Justification for Change:

These changes should be made for consistency with the referenced line items, and for consistency with our comments on AMP XI.S3 regarding such bolts. In addition, such changes should be made for consistency with previous comments and dispositions as documented in NUREG–1950 for such bolts, as well as, per comments provided in NEI Letters to NRC dated

08-06-14 and 06-04-15 on this topic. The SCC aging mechanism is not applicable for a given same bolting material (ASTM A325 or A490) in the same environment (air-indoor uncontrolled or air-outdoor) with the same structural support application and intended function. The support classification is (such as ASME Class I or any other classification) has no bearing on the applicability or not, of SCC to a given particular material and environment and intended function combination.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made.

Stress corrosion cracking (SCC) is an applicable aging effect for high-strength bolting (actual measured yield strength greater than or equal to 150 ksi or 1034 MPa) in sizes greater than 1 inch nominal diameter in ASME Code applications, and therefore retained in GALL-SLR Report AMP XI.S3, "ASME Section XI, Subsection IWF." There is relevant operating experience in EPRI NP-5769, Vol 1 ("Degradation and Failure of Bolting in Nuclear Power Plants") of brittle failure of nuclear steam supply system (NSSS) support bolting due to SCC, and the staff position is that for aging management, high-strength bolts with the properties described above that are included in ASME IWF applications, volumetric examinations should be performed for a sample of the bolts to determine whether cracking due to SCC has occurred. Note, this is not a change from the previous recommendation, it is a clarification that bolts meeting the criteria are subject to volumetric examination. The staff removed specific mention of ASTM A325 bolts because it is not likely that ASTM A325 bolting meeting the criteria is used. Also, note that volumetric examinations may be waived with adequate plant-specific justification. This plant-specific justification would need to consider the population of high-strength bolts in IWF supports and determine on a component basis whether SCC is a credible aging effect. An example could include a detailed evaluation of SCC susceptibility with verification of a non-corrosive environment, and/or a one-time volumetric examination to confirm SCC is not occurring. A490 bolts are not considered exempt from volumetric examination on a material basis alone.

Comment: 027

Location: SLR-GALL item III.B4.TP-44

Description of Change

Line item III.B4.TP-44 incorrectly refers to the XI.S3 AMP rather than the XI.S6 AMP.

Justification for Change:

Table B4 addresses component supports which are not ASME Class 1, 2, 3 or MC piping or component supports and are therefore not within the scope of the ASTM Section XI, Subsection IWF program. None of the other line items in this table reference the XI.S3 program.

RESPONSE:

The staff agreed with the comment and associated changes to the GALL-SLR Report have been made by removing GALL-SLR Report AMP XI.S3, "ASME Section XI, Subsection IWF," from the AMP column of GALL-SLR Report AMR item III.B4.TP-44. AMP XI.S3 was incorrectly included as a possible AMP, but because the referenced components are not ASME supports, GALL-SLR Report AMP XI.S6, “Structures Monitoring,” is the appropriate AMP.

Comment: 028

Location: SLR-GALL Ch. III, Table B5

Description of Change

Table B5 still exists but all line items have been deleted.

Justification for Change:

It is unknown whether this deletion was purposeful or an editorial omission. If purposeful, the table and all references to it should also be deleted and possibly some rationale or note should be added to address these changes.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. This was an error, so the items were returned to GALL-SLR Chapter III, Table B5.

Comment: 029

IX.B Use of Terms for Structures and Components

Description of Change and Justification (Basis)

1. The term and usage added to this document, page IX B-2 and IX B-3, for “Inaccessible Areas of Structural Components for non-ASME structural AMPs” should be deleted. It is new and not needed. There is no similar definition for ASME AMPs. This addition with the wording chosen in context of the sentence statement could lead to regulatory uncertainty and questions such as do coatings have to be removed, etc.

No Markup is provided as the recommendation is to delete this unnecessary definition.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. There is no similar definition for ASME AMPs because the associated ASME Code sections clearly identify what is considered inaccessible. This clarity did not previously exist for non-ASME AMPs. The new definition makes it clear what areas the staff considers inaccessible.

The staff disagreed that this definition introduces regulatory uncertainty in regards to protective coatings. Wording in each structural AMP makes it clear what is expected in regards to inspecting structures with protective coatings.

Comment: 030

IX.F Significant Aging Mechanisms

Description of Change and Justification (Basis):

1. Term and Usage in this document, page IX F-4: Please leave intact the Term "Deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)". The definition "Loss of sealing due to wear, damage, erosion, tear, surface cracks, other defects" is used throughout GALL-SLR, but lacks an associated Term. Furthermore, the term and its described usage are useful for the means of appropriately addressing aging of seals, gaskets, and moisture barriers.

Markup: Page IX F-4

IX.F Use of Terms for Aging Mechanisms	
Term	**Usage in this document**
Deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	~~Seals, gaskets, and moisture barriers (caulking, flashing, and other sealants) are subject to loss of sealing and leakage due to containment caused by aging degradation of these components.~~ Loss of sealing due to wear, damage, erosion, tear, surface cracks, other defects.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made.

Comment: 031

SLR-SRP Section 3.5, Subsections SRP 3.5.2.2.2.6, and 3.5.3.2.2.6
(FE Irradiation of Concrete)

Location: SLR-SRP Pages 3.5-6, -7, and -15;

SRP Sections 3.5.2.2.2.6, and 3.5.3.2.2.6

Description of Change

The recommendation should not be as prescriptive. It is recommended that plant specific concrete fluence calculations should not necessarily be required for all plants since options including allowing consideration of industry (EPRI) evaluations of this aging effect, as well as, bounding screening evaluations such as for BWR's will be available. An EPRI research Report on this topic is scheduled to be published in 2016.

Internal concrete heating due to neutron or gamma radiation should not be included in the further evaluation for this aging effect.

Justification for Change:

This potential aging effect is unlikely to impact BWRs, and may only impact portion of PWR fleet (approximately 11 plants) based on EPRI and DOE research and recent presentations. These plant specific calculations or evaluations have already been provided by EPRI. BWR reactor shield or sacrificial shield concrete is based on shielding (not for strength, as concrete is encased in thick structural steel plates) and BWR reactor vessel pedestal structure concrete and the reactor cavity above the BWR containment head (mentioned elsewhere) are located such that high fluence levels should not be a factor. An EPRI research Report on this topic is scheduled to be published in 2016.

Internal heating due to neutron or gamma radiation is a more immediate (small) potential temperature effect (as opposed to the long term fluence aging mechanism that may only affect some plants beyond 60 years) and it should not be an aging mechanism to be addressed, since it is not a current CLB issue. (See EPRI Report TR 3002002676 for additional information)

Markup

Further evaluation is recommended of a plant-specific program or program addition to manage reduction of strength, loss of mechanical properties, and of concrete due to irradiation in certain PWR and possibly BWR Group 4 concrete structures, exposed to high levels of neutron and gamma radiation. These structures include the reactor (primary/biological) shield wall~~, the~~ or 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, a~~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 are possible. 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/cm2 neutron radiation and 1 × 108 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, unless the unit type can be screened as not subject to such high fluence effects or unless the concrete is primarily for shielding and steel shells are provided for strength as in typical BWR Bio-Shield designs. 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, industry research, plant-specific evaluations) 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, or are otherwise evaluated, for example, that the concrete is primarily for shielding such as in a BWR Bio-shield. 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/evaluations) provided by the applicant to justify higher fluence or dose limits is reviewed. Otherwise, the applicant's proposed plant-specific program or program addition or plant specific evaluation 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.

RESPONSE:

The staff partially agreed with this comment. Portions of the proposed revisions were accepted that provided additional guidance on what may be included in the further evaluation.

The staff disagreed that it is appropriate to generically "screen out" particular plant designs based on ongoing industry research. If a generic approach is warranted based on industry research, a topical report (or similar document) should be prepared and submitted to the NRC for review. Otherwise, this aging effect needs to be addressed on a plant-specific basis. The staff did accept portions of the proposed revisions that provided additional guidance on what may be included in the evaluation.

Comment: 032

SLR-SRP Section 3.5, Subsections SRP 3.5.3.2.1.6, Cracking Due to Stress Corrosion Cracking

Location: SLR-SRP, Pages 3.5-10, SRP Section 3.5.3.2.1.6

Description of Change

See Comment 3 on XI.S1 AMP.

Only require supplemental surface examinations at penetrations and bellows without fatigue analyses.

Justification for Change:

Surface examinations (dye-penetrant examinations) of stainless steel and dissimilar metal welds of penetration sleeves are not required by the ASME Section XI, Subsection IWE Code or 10 CFR 50.55a. The 1992 ASME Code edition Subsection IWE required surface examination of dissimilar metal welds only, not stainless steel sleeves, etc. This previous requirement from the 1992 Edition of the code was eliminated from the 1998 version of the code Subsection IWE, and was evaluated and accepted by NRC as documented in the "Resolution of Public Comments Subsection IWE" based on a lack of any particular problem with stainless steel to low carbon welds in other systems in the plants. 10 CFR 50.55a(b)(2)(x)(C) issued at that time made the examination of pressure retaining welds and pressure retaining dissimilar metal welds optional.

Since there has been no additional applicable Operating Experience identified or cited to require surface examination for any of these components excepting possibly bellows, these recommendations should be eliminated or at least made applicable only to components subject to cyclic loading without a CLB fatigue analysis with the optional provision to use Appendix J examination as an alternative to surface examination as per NUREG–1801 recommendations.

Markup

SRP 3.5.3.2.1.6, Page 3.5-10

3.5.3.2.1.6 Cracking Due to Stress Corrosion Cracking

Source 019

Further evaluation is recommended of programs to manage cracking due to SCC for SS penetration sleeves, dissimilar metal welds, and penetration bellows in all types of PWR and BWR containments when conditions such as a corrosive environment are present. ~~*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 (such as only VT-3) ~~*and leak rate testing*~~ may not be sufficient to detect cracks, ~~*especially for dissimilar metal welds*~~. Additional appropriate examinations to detect SCC in 2-ply bellows assemblies ~~*and dissimilar metal welds*~~ are recommended when a corrosive environment is present or a CLB fatigue analysis does not exist~~*to address this issue*~~. The reviewer reviews and evaluates the applicant's evaluation and any proposed program~~s~~ addition to confirm that adequate inspection methods will be implemented where necessary to ensure that cracks are detected.

Note: It is also recommended that corresponding changes be made to 3.5.2.2.1.6 to eliminate mention of dissimilar metal welds from the last sentence.

RESPONSE:

The staff partially agreed with this comment and associated changes to the SRP-SLR and GALL-SLR Report have been made.

Changes to the GALL-SLR Report:

The "Further Evaluation" column was revised from "No" to "Yes" for the following GALL-SLR Report AMR items that correspond to SRP-SLR Table 3.5-1, items 38 and 39: II.B3.1.C-24, II.B3.2.C-24, and II.B1.1.CP-50. These conforming changes make SRP-SLR Table 3.5-1, items 38 and 39 consistent with item 10 for the "cracking due to SCC" aging effect/mechanism.

Changes to SRP-SLR:

The "Further Evaluation" column of SRP-SLR Table 3.5-1, items 38 and 39 was changed from *"No" to "Yes (SRP-SLR Section 3.5.2.2.1.6)*" to make it consistent with the further evaluation for detection of aging effect due to SCC for similar SRP-SLR Table 3.5-1, item 10.

SRP-SLR Section 3.5.2.2.1.6 was revised as below for components and evaluation considerations to be consistent for Table 3.5-1, items 10, 38, and 39:

3.5.2.2.1.6 Cracking Due to Stress Corrosion Cracking

Stress corrosion cracking (SCC) of stainless steel penetration sleeves, penetration bellows, vent line bellows, suppression chamber shell (interior surface), and dissimilar metal welds could occur in ~~all types of~~ PWR and/or BWR containments. The existing program relies on ASME Section XI, Subsection IWE and10 CFR Part 50, Appendix J, to manage this aging effect. Further evaluation, including consideration of SCC susceptibility and applicable operating experience related to detection, is recommended of additional appropriate examinations/evaluations implemented to detect ~~these~~ this aging effect~~s~~ for these SS components and dissimilar metal welds.

SRP-SLR Section 3.5.3.2.1.6 was revised as below for components and evaluation considerations to be consistent for Table 3.5-1, items 10, 38, and 39:

3.5.3.2.1.6 Cracking Due to Stress Corrosion Cracking

Further evaluation is recommended of programs to manage cracking due to SCC for stainless steel penetration sleeves, penetration bellows, vent line bellows, suppression chamber shell (interior surface), and dissimilar metal welds~~, and penetration bellows~~ in ~~all types of~~ PWR and/or 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~~ the listed SS components and dissimilar metal welds, considering SCC susceptibility and applicable operating experience (e.g., cracking of two-ply bellows) related to detection, 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.

The need for a supplemental surface examination to detect cracking due to SCC recommended for stainless steel and dissimilar metal weld components [e.g., components corresponding to SRP-SLR Table 3.5-1, item 10 (penetration sleeves and bellows), item 38 (suppression chamber shell inner surface), and item 39 (vent line bellows)] is now determined consistently, based on the further evaluation of detection of aging effects for SCC, including consideration of susceptibility for SCC and applicable operating experience (e.g., two-ply bellows cracking). Conforming changes in AMR items make SRP-SLR Table 3.5-1, items 38 and 39, and associated further evaluation and GALL AMR items, consistent with those for item 10 for "cracking due to SCC" aging effect/mechanism.

Comment: 033

SLR-SRP Section 3.5, Subsections SRP 3.5.3.2.1.8, 3.5.3.2.2.1.2, and 3.5.3.2.2.3.2 (FE Reaction with Aggregates)

Location: SLR-SRP Pages 3.5-11, -12, -13, -14; SRP Sections 3.5.3.2.1.8, 3.5.3.2.2.1.2, and 3.5.3.2.2.3.2

Description of Change

There is a need to add a significance threshold to the FE Review Procedures for Cracking due to Reaction with Aggregates (SRP 3.5.3.2.1.8, 3.5.3.2.2.1.2, and 3.5.3.2.2.3.2). These sections should have wording such as in 3.5.2.2.1.8, "is not significant if it is demonstrated that the in-place concrete can perform its intended function" or if it is determined that AAR "in accessible areas has no impact on the intended function of the concrete structure" (as per for leaching in SRP 3.5.3.2.1.9), then No Plant Specific evaluation or AMP is required.

Justification for Change:

Added wording is necessary to add a significance threshold and to be consistent with other SRP review procedures referenced i.e., SRP 3.5.2.2.1.8, and 3.5.3.2.1.9.

Considering SLR plants are over 40 years and AAR, if potentially significant, would manifest significant concrete growth e.g., reduced seismic gaps, movement/changes at doors/penetrations, and any reactions should be nearly complete/complete–consider possible alternatives such as one time inspections/evaluations. For example if petrographic examination finds that Akali-Silica Reaction is present but limited such that only a small percentage of the fine aggregate is reactive; it is possible that there will be no concrete damage, no resultant cracking, no growth or expansion, no effect on the physical properties of the concrete, and therefore, there will be no potential for structurally significant degradation and no potential adverse effect on the intended function of the structure.

Recommend that the wording "an effective inspection program has been developed and implemented to ensure that this aging effect in inaccessible areas is adequately managed", should be reworded clarifying that inspection of accessible areas is adequate for managing inaccessible areas. No OE warrants doing anything different or focused on inaccessible areas. The relevant Operating Experience for the only nuclear plant with potentially significant ASR identified in NRC Information Notice 2011-20 has performed examinations and evaluations with information obtained from the accessible sides of the concrete and has not found it necessary or helpful to excavate and perform an inspection program of the inaccessible areas as per SRP 3.5.3.2.1.8, 3.5.3.2.2.1.2, and 3.5.3.2.2.3.2 wording that "an effective inspection program has been developed and implemented to ensure that this aging effect in inaccessible areas is adequately managed".

SRP 3.5.3.2.1.8, 3.5.3.2.2.1.2, and 3.5.3.2.2.3.2, pages 3.5-11, -12, -13, -14

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 evaluation and possible additions to an AMP ~~*is*~~ may be necessary if (1) reactivity tests or petrographic examinations of concrete samples identify reaction with aggregates, or (2) visual inspections of accessible concrete have identified indications of aggregate reactions, such as "map" or "patterned" cracking or the presence of reaction byproducts (e.g., alkali-silica gel). The reviewer confirms that the applicant has not identified one of the above conditions, or that it has been demonstrated or determined that reaction with aggregates in accessible areas is not significant as it has no impact on the intended function of the concrete structure. Otherwise, the reviewer reviews the applicant's proposed additions to the AMP or plant specific evaluation to verify that, where appropriate, an effective evaluation, monitoring or inspection program has been developed and implemented to ensure that this aging effect ~~*in inaccessible areas*~~ is adequately managed monitored or evaluated.

RESPONSE:

The staff partially agreed with this comment and associated changes to the SRP-SLR and GALL-SLR Report have been made. The staff disagreed that a significance threshold should be included. Action should be taken if the indications in the SRP-SLR are met; however, the staff agreed that a plant-specific evaluation can be used to demonstrate that a plant-specific AMP may not be necessary.

The relevant SLR-SRP further evaluation sections have been revised to clarify that an evaluation can show no additional actions are necessary. Wording was also added to improve the guidance on what may indicate aggregate reactions are occurring. The SRP-SLR indications were identified based on the point at which the staff believes further evaluation needs to be conducted. The staff intended for an appropriate engineering evaluation to be an acceptable portion of the further evaluation.

Comment: 034

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

Location: XI.S1- IWE program (from pages 3.0-45 & 46)

Description of Change

1. Leak rate testing should be deleted.

2. References to liner bulges should be deleted.

3. The additional supplemental surface examinations need more detail.

4. Generic requirements for volumetric examinations of areas only accessible from one side should be deleted.

5. The statement about surface examination of structural bolting should be deleted.

Justification for Change:

1. The Appendix J program addresses leak rate testing. The IWE mentions leak rate testing where visual or surface examinations may not be adequate but does not contain the same level of detail as the Appendix J program.

2. See other comments for more detailed justification. In general, liner bulges are a normal result of a liner plate and there is no OE to indicate that liner bulges are an indication of corrosion.

3. It appears that some words were missing.

4. See other comments for more detailed justification. In general, this is beyond the Code, there is no relevant OE to justify this additional work.

5. This appears to be in error, as volumetric examination has been recommended to detect cracking where applicable of structural bolting, surface examination (PT or MT) is impractical for threaded areas and would require removal of bolts, also too much detail for AMP summary.

RESPONSE:

The NRC staff agreed with the comment in part, consistent with the response to Comments 019-043 through 019-045 and the conforming revisions made to GALL-SLR Report AMP XI.S1, "ASME Section XI, Subsection IWE."

The Final Safety Analysis Report (FSAR) Supplement Summary for AMP XI.S1 in GALL-SLR Report Table XI-01 has been accordingly revised.

Revise the "Description of Program" column for AMP XI.S1 in SLR-SRP Table 3.0-1, as marked up below.

This program is in accordance with ASME Section XI, Subsection IWE, consistent with 10 CFR 50.55a "Codes and Standards," with supplemental recommendations. The AMP includes periodic visual, surface, and volumetric examinations, ~~*and leak rate testing,*~~ where applicable, of metallic pressure-retaining components of steel containments and concrete containments for signs of degradation, damage, irregularities ~~*including liner plate* bulges~~, and for coated areas distress of the underlying metal shell or liner, and corrective actions. 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*~~. In addition, the program includes supplemental surface or enhanced examinations to detect cracking for stainless steel portions of containment penetrations where there is no fatigue analysis ~~*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. The FSAR Supplement Summary for AMP XI.S1 in GALL-SLR Table XI-01 and SRP-SLR Table 3.0-1 are revised to read as follows: *This program is in accordance with ASME Section XI, Subsection IWE, consistent with 10 CFR 50.55a "Codes and Standards," with supplemental recommendations. The AMP includes periodic visual, surface,* and *volumetric examinations,* ~~*and leak rate testing,*~~ where applicable, of metallic pressure-retaining components of steel containments and concrete containments for signs of degradation, damage, irregularities including liner plate bulges, and for coated areas distress of the underlying metal shell or liner, and corrective actions. 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*~~. In addition, the program includes supplemental surface ~~*or enhanced*~~ examination~~*s*~~ to detect cracking for specific pressure-retaining components [identify components] subject to cyclic loading but have no CLB fatigue analysis; and if triggered by plant-specific operating experience, a one-time supplemental volumetric examination~~*s*~~ by sampling randomly-selected as well as focused 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.

Comment: 035

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

Location: XI.S2- IWL program (from pages 3.0-46)

Description of Change

1. Change RG 1.35 to RG 1.35.1.

2. Note that ACI 349.3R Chapter 5 is a criteria to determine the level of evaluation required for examination results.

Justification for Change:

1. Lift off forces are calculated using RG 1.35.1 (refer to the GALL table for consistency).

2. See other comments for more detailed justification. In general, ACI 349.3R Chapter 5 is an evaluation criteria.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. See staff response to Comments 019-070 and 019-073.

The acceptance criteria should be properly set for the program (see response to Comment 019-070) so that significant indications are identified. Indications that are identified by the program should be entered into the Corrective Action program and thus receive a documented evaluation. The staff's intention was for monitoring and trending to occur for all significant findings. Significance is described by the appropriate acceptance criteria outlined in Element 6. In addition, text was added to clarify GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," Elements 5 and 6.

Comment: 036

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

Location: XI.S3- IWF program (from pages 3.0-46)

Description of Change

1. Delete the addition of 5% more supports to the scope of the program.

2. Add a clarification that volumetric examination of A325 and A490 bolts for cracking is not required.

Justification for Change:

1. See other comments for more detailed justification. In general, this is beyond the scope of the ASME Code, Section XI and 10 CFR 50.55a, and there is no relevant OE to justify this additional requirement.

2. See other comments for more detailed justification. In general, these bolt materials are carbon steel bolting materials not susceptible to SCC.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The staff clarified that the inspection of an additional 5 percent of supports is a one-time inspection conducted within 5 years prior to entering the subsequent period of extended operation.

The basis for adding/not deleting wording with respect to the SRP-SLR is tied to the basis for agreeing or disagreeing with the associated comments. The population of supports that are currently inspected in accordance with 10 CFR 50.55a include the same supports for each inspection interval. This nominal increase allows supports that have never been inspected to be verified to be representative of the entire population of supports, or could identify aging that is occurring in supports that have never been inspected during the life of the plant. Although other programs, walkdowns, or inspections could potentially identify age-related degradation of IWF supports, they may not, or issues may not be dispositioned appropriately to AMP XI.S3, "ASME Section XI, Subsection IWF." Operating experience should be an important consideration in determining the need for additional activities for the 60–80 year period; however, the sample chosen at the time the IWE Code was implemented in accordance with 10 CFR 50.55a, the sample selection required by ASME did not necessarily consider different aging mechanisms and effects necessary to be covered by aging management under 10 CFR Part 54. Addition of a select number of random inspections and inclusive of aging effects or environment most susceptible to degradation allows for better assurance that the AMP XI.S3 sample will be representative of the aging of the entire component support population during the subsequent period of extended operation.

SCC is an applicable aging effect for high-strength bolting (actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1 inch nominal diameter in ASME Code applications, and therefore retained in GALL-SLR Report AMP XI.S3. There is relevant OE in EPRI NP-5769, Volume 1, “Degradation and Failure of Bolting in Nuclear Power Plants,” of brittle failure of NSSS support bolting due to SCC, and the staff position is that for aging management, high-strength bolts with the properties described above that are included in ASME IWF applications, volumetric examinations should be performed for a sample of the bolts to determine whether cracking due to SCC has occurred. Note this is not a change from the previous recommendation, it is a clarification that bolts meeting the criteria are subject to volumetric examination. The staff removed specific mention of ASTM A325 bolts because it is not likely that ASTM A325 bolting meeting the criteria is used. Also note that volumetric examinations may be waived with adequate plant-specific justification. This plant-specific justification would need to consider the population of high-strength bolts in IWF supports and determine on a component basis whether SCC is a credible aging effect. An example could include a detailed evaluation of SCC susceptibility with verification of a non-corrosive environment, and/or a one-time volumetric examination to confirm SCC is not occurring.

Comment: **037**

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

Location: XI.S6-Structures Monitoring (from page 3.0-47)

Description of Change

1. Delete the reference to coatings.
2. Delete excessive detail with respect to recording results.

Justification for Change:

1. This comment is addressed in more detail under other comments for the AMP. In general, the condition provides little useful information regarding the underlying coating, except potentially for coating blisters due to corrosion of carbon steel.

2. This comment is addressed in more detail under other comments for the AMP. In general, the requirement is too broad to apply quantitative measurements and trending to all applicable parameters monitored or inspected since not all parameters lend themselves to quantitative measurements and not all parameters can be usefully trended.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The wording related to coatings was deleted.

As discussed in response to Comment 019-066, coatings are generally only included in the program as an indicator of the condition of underlying materials. Therefore, it is unnecessary to include a discussion of coatings in the FSAR Supplement.

The staff did not agree that “for significant findings” needs to be added to the FSAR Supplement. Acceptance criteria should be properly set so that “significant findings” are identified. This issue is discussed further in response to Comments 019-070 and 019-073. No change was made as a result of this portion of the comment.

Comment: 038

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

Location: XI.S7- Inspection of Water-Control Structures Associated with Nuclear Power Plants (from page 3.0-47 and 48)

Description of Change

Delete the phrase “for all applicable parameters monitored or inspected”.

Justification for Change:

This comment is addressed in more detail under other comments for the AMP. In general, the requirement is too broad to apply to quantitative measurements to all applicable parameters monitored or inspected since not all parameters lend themselves to quantitative measurements and not all parameters can be usefully trended.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The FSAR Supplement in the GALL-SRP Report have been edited to clarify that not all parameters lend themselves to quantitative measurements or trending.

The NRC staff understands that not all parameters lend themselves to quantitative measurements or trending. To acknowledge that, “applicable” was included in the original wording. To clarify this further, “all” was deleted in the final document. However, quantitative measurements exceeding the acceptance criteria should be recorded and trended for all parameters that lend themselves to quantitative measurements.

Source 019

Comment: 039

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

Location: XI.S8- Protective Coating Monitoring and Maintenance (from page 3.0-48)

Description of Change

Delete information referring to design purposes of Service Level 1 protective coatings.

Justification for Change:

The design purposes of coatings with respect to potential corrosion protection or decontamination are not relevant for this aging management program, which is intended to post-accident operability of ECCS. Other sections of the UFSAR would be the appropriate place to address the design purposes of the coatings, if necessary and accurate. This section is intended to describe aging management programs, not the design purposes of coatings.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made.

The NRC staff agreed that not all of the design functions of containment coatings are within the scope of license renewal aging management. However, the staff believed it is prudent to mention them, for completeness, in the program description. In addition, GALL Report Revision 2 only referred to "*RG 1.54 Rev 1, or latest revision*," without providing this level of detail. The NRC staff chose to paraphrase the RG instead of referring to the revision level in the GALL-SLR Report.

Comment: 040

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

Location: X.S1- Concrete Containment Tendon Prestress (from pages 3.0- 50 & 51)

Description of Change

Allow for corrective actions to maintain the minimum required prestressing force.

Justification for Change:

Containment tendon prestress force monitoring programs allow and require corrective actions to maintain the minimum required prestress force, as required. The programs are not limited to only analytical justification of the trend line.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made.

The FSAR Supplement is replaced with the following: "The program monitors and assesses the adequacy of the prestressing force for each tendon group based on type (i.e., hoop, vertical, dome, inverted-U, helical) and other considerations (e.g., geometric dimensions, whether affected by repair/replacement, etc.). The program ensures, during each inspection, that the trend lines of the measured prestressing forces remain above the minimum required value before the next scheduled inspections. Otherwise, corrective actions are taken to ensure containment prestress adequacy. Acceptance criteria follow 10 CFR 50.55a, ASME Section XI (Subsection IWL) and include construction of trend lines consistent with U.S. Nuclear Regulatory Commission (NRC) Information Notice (IN) 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete containments." The NRC Regulatory Guide (RG) 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," provides guidance for calculating prestressing losses and predicted forces. The program incorporates plant-specific and industry operating experience."

Comment: 041

SLR-SRP Section 4.5

Location: Tendon Prestress Analysis, Section 4.5.1, Page 4.5-1, lines 10 & 11

Description of Change

Clarify the OE references to no longer indicate that all OE shows a loss of prestress higher than predicted and refer to IN 99-10 that provides the background for the OE reference.

The GALL description for the OE with respect to loss of tendon prestress in AMP X.S1, Element #10 should be used in order to be consistent.

Justification for Change:

Not all plants lost tendon prestress at a rate higher than predicted due to elevated temperatures, for reasons such as a lack of exposure to elevated temperatures higher than anticipated and the original model for loss of tendon prestress adequately accounted for any higher temperatures.

The OE characterization does not reflect the current OE at operating plants where the loss of prestress is less than predicted. IN 99-10 refers to only a few plants within the early 20 years of initial operation. The predictions for loss of prestress have been corrected to reflect elevated temperatures, where needed, to accurately predict the loss of prestress. Loss of prestress at greater than predicted has not been the experience at most plants and is certainly not the experience of such plants approaching the PEO.

In any event, the rate of prestress loss, which decreases over time, will be very low during the period of SLR (years 60-80).

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The inclusion of the word "may" adds clarity to Section 4.5.1, "Areas of Review." The IN 99-10 is appropriately referenced.

Applicants are reminded when setting goals and performing periodic evaluations consistent with 10 CFR 50.65, they are required to consider industry-wide operating experience. Operating experience should be reflective of past, present, and anticipated future consequences of adverse environment and aging effects on tendon force prestress.

Post-tensioning systems are susceptible to the same degradation mechanisms as mild steel reinforcement plus loss of prestressing force, primarily due to tendon relaxation and concrete creep and shrinkage. Identified degradation includes concrete cracking, concrete freezing and thawing damage, corrosion of steel reinforcement, corrosion of post-tensioning tendon wires, anchor head failures due to stress corrosion cracking or hydrogen embrittlement, leaching of tendon gallery concrete, and larger than anticipated loss of prestressing forces.

Although IN 99-10 embraces past operating experience, more recent license renewal applications (LRA) reviews (40–60 years) have indicated tendon wire issues that could necessitate additional and augmented inspections and potential replacement of tendons prompting the staff to set licensing conditions that included licensee commitments for additional licensee efforts in maintaining the integrity of the prestressing system and adequacy of the tendon forces.

Comment: 042

SLR GALL X.S1 Concrete Containment Unbonded Tendon Prestress

Description of Change and Justification (Basis):

Elements 5 and 6, pages X.S1-1 and X.S1-2: The new SLR GALL recommendation/requirement for creation of a group PLL line and comparison of the group trend lines to a PLL line is not required by code, not supported by operating experience, and the ability to effectively implement this concept is questionable, and the value of such a comparison is not readily apparent. Comparison of individual tendon lift off forces to individual tendon PLL values and MRV is required by the IWL code. Given that the construction of the lines is based on a bilinear function that is meant to approximate a phenomenon that can be considered to follow a diffusion equation, i.e., a curve that asymptotically approaches zero change, and that the majority of prestress losses occur in the first 5 years, the crossing of PLL and regression analysis trending lines between 60-80 years is much less important than projecting the regression analysis trend line versus the MRV line, as is required by the Code. We agree that a comparison to the PLL is very important early in plant life, but consider that such PLL comparison is not as important once we are in years 60-80 where the loss of prestress is approaching zero. The recommendation for creation of and comparison of the group trend lines to a PLL line is not required by code and is of questionable value. Once in SLR the rate of prestress loss will be very small and will likely be less than the ability to effectively measure the loss of prestress. The additional work to take the existing predicted lower limit values calculated for each individual tendon at various points in time and plot them and develop a group PLL (Trend) Line is an exercise of questionable value the need for which is not supported by operating experience and is not required by the IWL code. A previous comment on this topic was included in the attachment to NEI Letter to NRC dated 06-04-15. It is recommended that this PLL line recommendation/requirement be eliminated from the draft SLR GALL X.S1 AMP and associated sections of the GALL Table X-01 program description and SRP Table 3.0-1 Table for X.S1 and for SRP 4.5. Note that this comment was previously made in the attachment to NEI Letter to NRC dated 08-06-14.

Markup pages X.S1-1 and X.S1-2

5. *Monitoring and Trending*: ~~*In addition to Subsection IWL examination requirements, the estimated and all*~~ Measured prestressing forces up to the current examination are plotted

against time. The ~~predicted lower limit (PLL) line, MRV, and~~ trend lines are developed for each tendon group examined, for the subsequent period of extended operation. The trend line represents the general variation of prestressing forces with time based on the actual measured forces in individual tendons of the specific tendon group. The trend line for each tendon group is constructed by regression analysis of all measured prestressing forces in individual tendons of that group obtained from all previous examinations. The ~~PLL line, MRV, and~~ trend line for each tendon group are projected to the end of the subsequent period of extended operation. The trend lines are updated at each scheduled examination and compared with the MRV (Minimum Required Value).

6. Acceptance Criteria: The prestressing force trend line (constructed as indicated in the Monitoring and Trending program element) for each tendon group must indicate that existing prestressing forces in the concrete containment tendon would not fall below the ~~appropriate MRV prior to the next scheduled examination. If the trend line crosses the PLL line, its cause should be determined, evaluated and corrected. The trend line crossing the PLL line is an indication that the existing prestressing forces in concrete containment could fall below the MRV.~~ Any indication in the trend line that the overall prestressing force in any tendon group(s) could potentially fall below the MRV during the subsequent period of extended operation is evaluated, the cause(s) is/are documented, and corrective action(s) is/are performed in a timely manner.

RESPONSE:

The staff did not agree with this comment and no changes to the GALL-SLR Report have been made. The Predicted Lower Limit (PLL) of tendon forces provides the marker of where the post-tensioned state of the containment structure should be at any given time. The PLL tendon force lines are plant-specific and evaluated consistent with RG 1.35.1. According to the RG, the PLL tendon force lines should address tendon losses from initial seating and should be periodically updated to the end-of-plant life.

The RG also states “[t]olerance bands for groups and subgroups of tendons should be constructed and should be used for comparison of measured prestressing forces with the forces predicted for the time of inspection.” When an applicant claims consistency of its AMP with that of the GALL-SLR Report, it should incorporate in the application the PLL lines so that “...measured values can be compared with its prescribed tolerance band.”

RG 1.35.1 aims to provide a high degree of confidence in the performance capability of the post-tensioning system, and the opportunity of timely corrective actions should the development of potentially adverse conditions be detected.

Comment: 043

XI.S1 ASME Section XI, Subsection IWE

1) Emphasis on UT of Containment shell or liner surfaces inaccessible from one side and not subject to degradation–Recommend requiring no additional UT examinations beyond what is code required and per 10 CFR 50.55a for steel liners.

Page # XI.S1-1, lines 29-32, Program Description; Page # XI.S1-4, lines 8-15, Element # 4, Detection

Source 019

Description of Change:

Delete volumetric examination of metal shell or liner surfaces that are inaccessible from one side.

Basis:

The recommendations for UT of liner areas accessible from one side are beyond the ASME B&PV Section XI, Subsection IWE Code and 10 CFR 50.55a requirements and there is no Operating Experience to justify the additional examinations on either a one-time or a continuous basis.

IWE-3511.3 Ultrasonic Examination-

Subsection IWE requires ultrasonic thickness measurements in two cases:

1. When an area subject to Augmented Examination in accordance with IWE-1240 is accessible from one-side only (IWE-2500(b)(2)).

2. To determine the minimum wall thickness of an area after degradation has been detected, if specified as a result of the engineering evaluation of the degraded area, as required by IWE-3200.

The requirement for augmented examinations includes findings of actual losses and does not include locations or configurations which could only potentially be subject to losses. In cases where corrosion is sufficient to result in material loss and the liner is accessible from one side, determination of liner thickness is appropriate and in accordance with the code. IWE 2420(d) only requires successive examinations until one re-examination in the next period determines that the condition has remained unchanged. It does not require augmented examinations forever.

It should also be noted that revision 3 of the Subsection IWE Commentary (2007) on page 17 regarding IWE-2500(b)(2) discussed that there had been some confusion as to whether earlier editions of the code or addenda required performance of ultrasonic thickness measurements whenever either side of a component was inaccessible whether or not the inaccessible side was subject to conditions which warrant augmented examination. The IWE Commentary stated “This was clearly not the intent, and this requirement was clarified in the 2001 Edition.”

The international experience cited as suggesting the presence of concrete voids as a possible concern for liner corrosion, consists of a single isolated incidence of leakage adjacent to an electrical penetration, early in the operating history of the Barseback-2 nuclear plant (which along with Barseback-1 has a unique containment liner configuration in the industry) as a result of poorly consolidated concrete and voids. Additionally, investigations and examinations were conducted at Barseback-1 at various penetrations with similar concrete consolidation and void issues. There was no corrosion found such that an unidentified construction difference or issue concurrent with the identified poorly consolidated concrete that was deemed causative.

In fact, based on industry operating experience, as documented in NRC sponsored report “Sandia Report SAND2010-8718 Nuclear Containment Steel Liner Corrosion Workshop: Final Summary and Recommendation Report” for Nuclear Plants in the USA, corrosion starting from the concrete side of the liner and corroding through to the interior surface of the liner has only been discovered as a result of foreign material being left in place during original construction. In addition, the Sandia report also states: “Tolerances issues with the liner are not considered significant since bulges in the liner between anchors are acceptable in design and do not impact liner structural performance.” and “Liner bulges would be identified through visual inspections, but occurrence of liner bulges would likely be from sources other than corrosion (e.g., pre-stressed containment with internal heating that expands the liner between anchorage locations).”

A US nuclear power plant has had a multiple occurrences of through wall corrosion due to construction errors where organic material was left against the liner committed to performance of a number of random UT examinations (25). The recent results of those UT examinations did not find loss of material due to corrosion occurring on the concrete side of the liner at those locations.

The industry operating experience and plant specific information and operating experience support a conclusion that corrosion will not occur on the concrete side of the containment liner as a result of bulges or water infiltrating the concrete. Therefore, corrosion of the outside or concrete side of the liner is not expected.

Steel liner corrosion from the concrete side of concrete containments where corrosion resulted in through-wall liner holes were due to latent construction errors such as organic material left against the liner. These construction errors were limited in number, apparently did not occur at most plants, and are not being created over time. Considering the history of the operating experience, corrosion rates found and the thicknesses of the liners, all of the potential construction errors would have revealed themselves before the start of the period of extended operation (beyond 40 years), which is well before the start of second license renewal (SLR), 60 years after construction.

Therefore, there is no relevant operating experience or technical basis to recommend or require additional UT examinations beyond those required by the code and 10 CFR 50.55a for steel liners during second license renewal (SLR).

Besides the cost to identify the areas of the containment shell and liner surfaces inaccessible from one side, perform the examinations (which would include support functions such as scaffolding and radiation protection), there will be a significant dose involved, depending upon the areas involved.

By the time of SLR, the areas of the containment shell and liner surfaces inaccessible from one side will have been in place for 60 years, so volumetric examination of areas of the containment shell and liner surfaces inaccessible from one side is expected to provide negligible benefits with regards to aging management since there has been no relevant, plant specific OE to suggest a basis for such volumetric examinations.

RESPONSE:

The staff partially agreed with the comment. The related descriptions in the Program Description and Detection of Aging Effects program elements of GALL-SLR Report AMP XI.S1, “ASME Section XI, Subsection IWE,” have been revised considering the comment, in order to base the recommendation for supplemental ultrasonic testing (UTs) based on a trigger of plant-specific operating experience.

Applicable program elements of AMP XI.S1 were revised as marked up below:

The last sentence in the last paragraph of the “Program Description” of AMP XI.S1 has been revised as follows:

> The program is also supplemented to perform surface examination' of pressure-retaining components that are subject to cyclic loading but have no current licensing basis (CLB) fatigue analysis; and, based on plant-specific OE, a one-time volumetric examination of metal shell or liner surfaces that are inaccessible from one side~~, during each inspection interval~~.

The last paragraph of the Detection of Aging Effects program element of AMP XI.S1 has been revised to read as follows:

> The requirements of ASME Section XI, Subsection IWE and 10 CFR 50.55a are further supplemented to require a one-time volumetric examination of metal shell or liner surfaces that are inaccessible from one side, only if triggered by plant-specific operating experience ~~during each inspection interval~~. The trigger for this supplemental examination is plant-specific occurrence of any instance of metal shell or liner corrosion initiated on the inaccessible side or areas, since the date of issuance of the first renewed license. ~~The~~ This supplemental volumetric examination consists of ~~(1) a sample of one-foot square randomly selected locations and (2)~~ a sample of one-foot square locations that included both randomly-selected, and focused~~-on~~ areas most likely to experience degradation based on operating experience and/or other considerations such as environment. Any identified degradation is addressed in accordance with the applicable provisions Subsection IWE. The sample size, locations, ~~frequency and~~ ~~schedule~~ and any needed scope expansion for ~~each~~ this one-time set of volumetric examinations should be determined on a plant-specific basis ~~during each interval.~~ to demonstrate statistically with 95 percent confidence that 95 percent of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10 percent loss of nominal thickness. Guidance provided in EPRI TR-107514 may be used for sampling considerations.

The "References" section of AMP XI.S1 has been revised to add the following reference:

_____. EPRI TR-107514, "Age-Related Degradation Inspection Method and Demonstration." In Behalf of Calvert Cliffs Nuclear Power Plant License Renewal Application. Palo Alto, California: Electric Power Research Institute. April 1998.

The staff agreed that operating experience should be an important consideration in determining additional supplemental volumetric examinations for potential corrosion initiated on the inaccessible side of a containment metal shell or liner. Therefore, the provision for supplemental volumetric examinations in AMP XI.S1 has been revised to a one-time examination based on a trigger of the plant-specific occurrence or recurrence of any instance of corrosion of the containment metal shell or liner initiated on the inaccessible side or areas, since the date of issuance of the first renewed license. This examination will consist of samples of both randomly-selected and focused locations most likely to experience degradation based on operating experience and other considerations, such as environment. The sample size and locations are determined on a plant-specific basis to demonstrate statistically with 95 percent confidence that 95 percent of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10 percent loss of nominal thickness.

The staff further noted that it understands the requirements of the ASME Code, Section XI, Subsection IWE, as incorporated by reference in 10 CFR 50.55a. With regard to augmentations to the requirements of ASME Code Section XI in some AMPs, the commenter is referred to the

Section entitled “References to ASME Code Section XI Used in This Report” in Chapter I of GALL-SLR Report.

Aging management programs for a renewed license for long-term operations are primarily intended to address deltas in existing requirements such that aging effects on systems, structures, and components (SSCs) are adequately managed so that intended functions are maintained consistent with the current licensing basis (CLB) for the period of extended operation, and not meant to be an exact repetition of existing code requirements. Currently, there is no available operating experience of aging degradation of containment metal shell/liner for 60–80 years of plant operation. Most past cases of through-wall corrosion of the containment metal shell or liner have been attributed to the presence of foreign material due to inadequate practices or housekeeping at the time of construction, and there is no guarantee that such foreign material is not likely in other plants. Further, plant aging degradation may be significant in the future from degradation processes such as cracking, carbonation, and chloride ingress and may contribute to the initiation and propagation of corrosion degradation of the containment shell or liner on the concrete side. Containment design and operation also could be a contributing factor.

The containment metal shell or liner serves a very important safety function to provide structural and/or leak-tight integrity under design basis loads under normal operation and accident conditions. Corrosion that originates between the shell or liner and concrete is a greater concern because the IWE visual examinations typically identify the corrosion only after it has significantly degraded the shell or liner (e.g., through-wall), as has been indicated in several instances of past operating experience described in several NRC INs and technical reports. Based on review of past industry operating experience that addressed the cause and significance of localized through-wall or partial corrosion of containment metal shell or liner initiated on the inaccessible (shell/liner-concrete interface) side and considering the important safety function of the containment metal liner or shell, it is reasonable for the AMP for SLR to recommend a one-time supplemental volumetric examination. Any further actions are determined, consistent with applicable provisions of the Subsection IWE AMP, based on the findings. The criteria provided for plant-specific determination of a statistically-based sample size and locations for this one-time trigger-based supplemental volumetric examination is consistent with that implemented by Beaver Valley, as part of its license renewal commitments to address their plant-specific operating experience of through-wall liner corrosion initiated on the inaccessible side.

Additionally, the one-time trigger-based provision for supplemental volumetric examination provides a means of plant-specific verification that its operating experience of shell or liner corrosion initiated on the inaccessible surface, if observed in a later part of its service life, is not a larger issue beyond localized area(s), and a confirmation of the expected effectiveness of the AMP for long-term operation to 80 years.

Comment: 044

XI.S1 ASME Section XI, Subsection IWE

2) New requirements for Bulges in Liner–Corrosion at liner bulges is not a relevant aging mechanism that requires consideration

Page # XI.S1-3, lines 7 and 9, Element # 3, Parameters; Page # XI.S1-3, lines 38-39, Element # 4, Detection; Page # XI.S1-5, lines 25-26, Element # 6, Acceptance Criteria

Description of Change:

Source 019

Delete requirements for examination of bulges.

Basis:

Bulges in steel liners of concrete containments are significantly different than blisters in the coating of the steel liner plates. The bulges or localized buckling of steel liners in concrete containments that have been identified at a number of plants are both anticipated and expected. Bond between the liner and concrete is not a design requirement and a separation of the liner from concrete is acceptable. Separation of liner from concrete surface can occur due to compressive strains induced due to various conditions including: expected creep and shrinkage of the concrete, dead loads, post-tensioning loads, and thermal loads. Deformations can also occur during construction due to welding of stiffeners and embedment plates to the liner. Liners have typically been surveyed after construction and such liner deformations which also may be termed as bulges or buckling have typically been found to be within allowable tolerances and also found within design tolerances for liner strain.

The reliability of repeated measurements of liner bulges is limited due to variability in relative displacements between the concrete shells and the liner. As a result, monitoring of bulge dimensions will result in no significant data that can be used to make decisions.

The international experience cited as suggesting the presence of concrete voids as a possible concern for liner corrosion, consists of a single isolated incidence of leakage adjacent to an electrical penetration, early in the operating history of the Barseback-2 nuclear plant (which along with Barseback-1 has a unique embedded containment liner configuration in the industry) as a result of poorly consolidated concrete and voids. Additionally, subsequent investigations and examinations were conducted at Barseback-1 at various penetrations with the same concrete consolidation and void issues. There was no corrosion found such that an unidentified construction difference or issue concurrent with the identified poorly consolidated concrete that was deemed causative. Coating blisters and through wall corrosion of steel liners have been due to construction errors that left organic material in concrete adjacent to the steel liner plates at a few plants. Based on timing of operating experience and liner thickness, corrosion due to organic material construction errors was and would be visually manifested as coating blisters well before first PEO (SAND2010-8718). Corrosion of the concrete side of liner resulting in significant loss of material will not occur except due to organic material left as a result of original construction errors. The above statements are also consistent with ML112070867 “Containment Liner Corrosion Operating Experience Summary Technical Letter Report–Revision 1” dated August 2, 2011. In fact, based on industry operating experience, as documented in NRC sponsored report “Sandia Report SAND2010-8718 Nuclear Containment Steel Liner Corrosion Workshop: Final Summary and Recommendation Report” for Nuclear Plants in the USA, corrosion starting from the concrete side of the liner and corroding through to the interior surface of the liner has only been discovered as a result of foreign material being left in place during original construction. In addition, the Sandia report also states: “Tolerances issues with the liner are not considered significant since bulges in the liner between anchors are acceptable in design and do not impact liner structural performance.” and “Liner bulges would be identified through visual inspections, but occurrence of liner bulges would likely be from sources other than corrosion (e.g., pre-stressed containment with internal heating that expands the liner between anchorage locations).” Corrosion at liner bulges not a relevant aging mechanism for consideration. Operating experience does not indicate liner corrosion at the bulges where the liner separates from the concrete. Additionally, based on the age of our early plants, our industry operating experience demonstrates that loss of material due to corrosion at liner bulges is not a relevant aging mechanism that we need to consider. Coating blisters are explored as part of the current IWE program.

Besides the cost to identify the bulges, perform the examinations (which would include support functions such as scaffolding and radiation protection), there will be a significant dose involved, depending upon the areas involved.

By the time of SLR, the bulges of the liner will have been in place for 60 years, so examination of bulges is expected to provide negligible benefits with regards to aging management if there have has been no plant specific OE to suggest the bases for the examinations.

RESPONSE:

The staff partially agreed with the comment.

Some changes were made to the GALL-SLR Report AMP XI.S1, "ASME Section XI, Subsection IWE," to clarify the staff position with regard to bulges. Applicable program elements of GALL-SLR AMP XI.S1 were revised as marked up below.

3. Parameters Monitored or Inspected:

> Noncoated surfaces are examined for evidence of cracking, discoloration, wear, pitting, excessive corrosion, arc strikes, gouges, surface discontinuities, dents, and other signs of surface irregularities <u>including discernible liner plate bulges</u>. Painted or coated surfaces, including those inside BWR suppression chambers, are examined for evidence of flaking, blistering, peeling, discoloration, and other signs of potential distress of the underlying metal shell or liner <u>system, including discernible liner plate bulges</u>. Stainless steel…

4. Detection of Aging Effects:

The following was appended to the first sentence in the second paragraph:

> Regarding the extent of examination, all accessible surfaces receive at least a general visual examination as specified in Table IWE-2500-1 and the requirements of 10 CFR 50.55a<u> with results evaluated in accordance with IWE-3100</u>.

The following was appended to the second paragraph of "Operating Experience" program element.

> Some examples of operating experience related to liner bulges are noted in NUREG-1522, and Enclosure 2 to NRC Inspection Progress Report 05000302/2011009 dated May 12, 2011.

The following was added to the References section.

> _____. Inspection Progress Report 05000302/2011009, Crystal River Nuclear Plant – Steam Generator Replacement Inspection Progress Report. ADAMS Accession Number ML111330350. May 12, 2011.

> The staff agreed that bulges may not be caused by corrosion and the presence of bulges in itself is not indicative of corrosion, and need not be specifically monitored for corrosion potential. Also, bulges in steel liners are different than blisters in the coating of liner plates; however, liner bulges can exist in both coated and noncoated

liner surfaces. The staff did not intend to consider bulges analogous to coating blisters, as implied in the comment; however, recognizes that bulges can also exist in liner surfaces that are coated and the distinction can be made by examination. The staff clarified the existing requirement that 100 percent of accessible containment surfaces, including those with bulges, are required to be inspected under the general visual examination requirements of the ASME Section XI, Subsection IWE, incorporated by reference in 10 CFR 50.55a. Bulges are considered included in Subsection IWE as “other signs of distress” or “other signs of surface irregularities.” The staff does not expect UTs to be specifically performed on bulges to evaluate for corrosion, unless other signs of potential corrosion of the concrete-liner interface or operating experience exists at or near a bulge. The staff understands the design requirements of the liner and the potential causes of bulges. Inward curvature (bulges) of the liner cause unbalanced forces and deformation on the liner anchorage to concrete, *and* whose effects are required to be considered in design. Bulges could affect liner anchorage to concrete and liner performance as designed. The staff position is that the presence of bulges should be documented and visually monitored, and visual observations of discernible changes in existing bulge features or occurrence of new discernible bulges should be evaluated by the responsible individual in accordance with the responsibilities delineated in IWE-2320 and the evaluation of examination results requirements in IWE-3100.

Occurrence of liner bulges would generally be from sources other than corrosion, and aging management of inaccessible areas of the liner (which includes the concrete side of a bulge) for corrosion is managed by other aspects of AMP XI.S1 based on augmented examination or UT of suspect areas based on findings from visual examinations. Liner bulges typically originate from construction activities or an event, but may grow due to additional compressive strains resulting from aging mechanisms, such as creep of concrete under sustained post-tensioning and dead loads, concrete shrinkage, and temperature; or these parameters exceeding that considered in design. Bulging is identified as a degradation mechanism in Figure 5.3 (pages 79–80) of the Expanded Materials Degradation Assessment (EMDA) Report (NUREG/CR–7153) Volume 4, as a degradation of the steel liner, with ranking of high susceptibility (and high confidence), high knowledge, and medium structural significance, as well as in the evaluation criteria in industry standard ACI 349.3R. During inspections and audits, the staff has also observed licensees applying IWE consistent with the indicated staff expectation with regard to bulges.

Comment: 045

XI.S1 ASME Section XI, Subsection IWE

3) New requirements for surface examination (dye-penetrant examinations) of SS and dissimilar welds of penetration sleeves apply regardless of whether subject to cyclic loading, or SCC, and regardless of whether CLB Fatigue analysis exists. The requirements refer to a superseded Code section that is inconsistent with the SLR GALL. The requirements appear to question the adequacy of the Appendix J CLB.

Page # XI.S1-1, lines 29-31, Program Description; Page # XI.S1-3, lines 9-11, Element # 3, Parameters; Page # XI.S1-3, lines 42-43, Element # 4, Detection; Page # XI.S1-4, lines 1-15, Element # 4, Detection; Page # XI.S1-5, lines 21-22, Element # 6, Acceptance Criteria

Description of Change:

a. Only require supplemental surface examinations at penetrations and bellows without fatigue analyses.

b. Change the reference from “Table IWE-2500-1, Examination Category E-F, as specified in the 1995 edition with 1996 addenda of the ASME Code, Section XI, Subsection IWE” to “IWE-3200”.

c. Refer to Appendix J pressure tests, which addressed in another GALL section, as in accordance with the CLB and do not require a justification of Appendix J testing as part of IWE.

Basis:

a. Primary Containment stainless steel penetration sleeves and/or dissimilar metal welds on penetration sleeves are sheltered and protected from a corrosive environment. Based on the industry operating experience reviews documented in NUREG–1801 Rev. 2 Section XI.S1, NRC Information Notice 92-20, NUREG/CR-6726, and NUREG–1950, Table IV-13, Comments 899 and 902; as well as in the DRAFT SLR GALL/SRP; industry OE has not identified cracking due to cyclic loads or SCC as a relevant aging effect for dissimilar metal welds or stainless steel containment penetration sleeves.

   Surface examinations (dye-penetrant examinations) are not required by IWE Code or 10 CFR 50.55a. The 1992 ASME Section XI, Subsection IWE Code required surface exams of dissimilar metal welds only–but the requirement was eliminated from Subsection IWE prior to the 1999 IWE implementation under 10 CFR 50.55a. The NRC agreed to the elimination of the surface examinations based on a lack of any OE for cracking with such welds and due to the expected dose that would be incurred to perform the surface examinations.

   Most of the external surfaces of carbon steel penetration sleeves and also of stainless steel penetration sleeves, where stainless steel penetration sleeves exist, are embedded in the four to six foot thick concrete containment walls; the remainder of the external surface is subject to the air-indoor uncontrolled environment. 10 CFR 50 Appendix J, type B tests of such penetration sleeves are not required and not possible for the type of mechanical penetration sleeves which are open between the pipe and the penetration sleeve on one end.

   Surface examinations (dye-penetrant examinations) of stainless steel and dissimilar metal welds of penetration sleeves are not required by the ASME Section XI, Subsection IWE Code or 10 CFR 50.55a. The 1992 ASME Code edition Subsection IWE required surface examination of dissimilar metal welds only, not stainless steel sleeves, etc. This previous requirement from the 1992 Edition of the code was eliminated from the 1998 version of the code Subsection IWE, prior to the 1999 IWE implementation under 10 CFR 50.55a, and was evaluated and accepted by NRC as documented in the “Resolution of Public Comments Subsection IWE”. The NRC agreed to the elimination of the surface examinations of dissimilar metal welds based on a lack of relevant OE for cracking with such dissimilar metal welds in other similar systems and due to the expected dose that would be incurred to perform the surface examinations.

There has been no additional relevant Operating Experience identified or cited to require surface examination for any of these components. The cited OE possibly applies to bellows where corrosive contamination was likely present. Therefore, these recommendations should be eliminated or at least made applicable only to components subject to cyclic loading without a CLB fatigue analysis with the optional provision to use Appendix J examination as an alternative to surface examination as per NUREG–1801 recommendations.

Supplemental surface examinations of stainless steel and dissimilar metal welds of penetration sleeves and closures are: 1) not necessary because the required parameters for SCC are not present, 2) not required by code or 10 CFR 50.55a, and not recommended in NUREG–1801 AMP XI.S1 for penetration sleeve components subject to cyclic loading which have a current licensing basis fatigue analysis, and 3) are not possible for the major portion of such components due to the fact that stainless steel penetrations are embedded in the four to six foot thick concrete primary containment walls.

Surface examination of the subject penetration sleeve components subject to cyclic loading which have a current licensing basis fatigue analysis is not recommended or required by NUREG–1801 AMP XI.S1 and there is no apparent operating experience or technical basis for now requiring such additional periodic dye-penetrant surface examinations for subsequent or second license renewal. NRC previously concluded that inspections of dissimilar metal welds were not warranted. We believe that this conclusion still applies and also applies to stainless steel sleeves. No recent relevant OE has been identified or cited to change the previous NRC conclusion.

Therefore, such additional dye-penetrant surface examinations of stainless steel and dissimilar metal welds of penetration sleeves will be an additional expenditure of resources, with no sound basis and no apparent value added cost benefit basis. These recommendations should be eliminated or at least made applicable only to components subject to cyclic loading without a CLB fatigue analysis with the optional provision to use Appendix J examination as an alternative to surface examination as per NUREG–1801 recommendations.

b. Table IWE-2500-1, Examination Category E-F, as specified in the 1995 edition with 1996 addenda of the ASME Code, Section XI, Subsection IWE, note #4 for "Parts Examined" limits the surface examinations to dissimilar metal welds subject to cyclic loads and thermal stresses during normal plant operations. This appears to contradict the first sentence that supplements the visual examinations with surface examinations at components that have no CLB fatigue analysis. In addition, the referenced table refers to figures and sections that no longer exist. Supplemental examinations, both surface and volumetric, are currently addressed in IWE-3200. The reference to the Table from 1995, if only intended to identify the scope, selection, and frequency, of the dissimilar metal weld surface examinations is confusing since it addresses other aspects and results in regulatory uncertainty.

c. Pressure testing, in accordance with Appendix J requirements, is addressed under another GALL section and is addressed in-depth under the CLB. Requiring a justification of the pressure testing under the IWE section of GALL results in regulatory uncertainty regarding how these requirements could be met.

RESPONSE:

The staff partially agreed with the comment. The GALL-SLR Report AMP XI.S1, "ASME Section XI, Subsection IWE," recommendations for surface examination to detect cracking, associated AMR items, and/or further evaluation are in principle, reverted similar to those in GALL Report, Revision 2. However, due to lack of clarity in the AMP and/or inconsistency between related AMR items in these existing guidance documents, some changes have been made to the related GALL-SLR Report and SRP-SLR provisions to explicitly clarify the recommendations.

The applicable program elements of GALL-SLR AMP XI.S1 were revised as marked up below:

The last sentence in the last paragraph of the "Program Description" of AMP XI.S1 has been revised as follows:

> The program is also supplemented to perform surface examination' of pressure-retaining components that are subject to cyclic loading but have no current licensing basis (CLB) fatigue analysis; and, based on plant-specific OE, a one-time volumetric examination of metal shell or liner surfaces that are inaccessible from one side~~, during each inspection interval~~.

3. the Parameters Monitored or Inspected element was revised as follows::

> … distress of the underlying metal shell or liner. Steel, stainless steel (SS), and dissimilar metal weld pressure-retaining components ~~of penetration sleeves, penetration bellows, and vent line bellows; and, steel bellows components~~ that are subject to cyclic loading but have no current licensing basis (CLB) fatigue analysis (i.e., components coverd by Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SRP-SLR) Table 3.5-1, items 27 and 40, and corresponding GALL-SLR items, as applicable), are monitored for cracking. The moisture barriers are examined...

4. Detection of Aging Effects:

> The requirements of ASME Section XI, Subsection IWE and 10 CFR 50.55a are supplemented to perform surface examination (or other applicable technique), in addition to visual examination, to detect cracking in~~(a)~~ steel, SS and dissimilar metal weld~~s~~ pressure-retaining ~~of penetration sleeves, penetration bellows, and vent line bellows;~~, ~~and (b) steel bellows~~ components that are subject to cyclic loading but have no CLB fatigue analysis (i.e., components coverd by SRP-SLR Table 3.5-1, items 27 and 40, and corresponding GALL-SLR items, as applicable to the plant). ~~The supplemental surface examination of dissimilar metal welds may be performed in accordance with Table IWE-2500-1, Examination Category E-F, as specified in the 1995 edition with 1996 addenda of the ASME Code, Section XI, Subsection IWE. Components for which supplemental surface examination is not feasible are identified and~~ Where feasible, appropriate Appendix J leak rate tests (GALL-SLR Report AMP XI.S4) capable of detection of cracking may be performed or credited in lieu of the supplemental surface examination; the type of leak test determined to be appropriate is identified with the basis for components for which this option is used.~~justified to detect cracking are conducted in lieu of the supplemental surface examination. For two-ply bellows of the type described in NRC IN 92-20 for which it~~

~~is not possible to perform a valid local leak rate test, augmented examination using qualified enhanced techniques that can detect *cracking is recommended*.~~

6. Acceptance Criteria:

accordance with IWE-3122 or accepted by engineering evaluation. Cracking of steel, SS and dissimilar metal weld pressure-retaining components ~~of penetration sleeves, penetration bellows, and vent line bellows;~~, ~~and steel bellows components~~ that are subject to cyclic loading but have no CLB fatigue analysis (i.e., components coverd by SRP-SLR Table 3.5-1, items 27 and 40, and corresponding GALL-SLR items, as applicable) is corrected by repair or replacement or accepted by engineering evaluation.

GALL-SLR items II.A3.CP-37 and II.B4.CP-37 were revised to make the “Structure and/or component” column to be consistent with SRP-SLR item 3.5-1, 027.

GALL-SLR items II.A3.C-13 and II.B4.C-13 were revised to make the “Structure and/or component” column to be consistent with SRP-SLR item 3.5-1, 009.

The “Further Evaluation” column was revised from *“No” to “Yes”* for the following GALL-SLR Report AMR items that correspond to SRP-SLR Table 3.5-1, items 038 and 039: II.B3.1.C-24, II.B3.2.C-24, and II.B1.1.CP-50. These conforming changes were intended to make SRP-SLR Table 3.5-1, items 038 and 039 consistent with item 010 for the “cracking due to SCC” aging effect/mechanism.

Changes to SRP-SLR:

SRP-SLR Table 3.5-1, item 027 was revised to make the components the same as for item 009.

The “Further Evaluation Recommended” column of SRP-SLR Table 3.5-1, items 038 and 039 were changed from *“No” to “Yes (SRP-SLR Section 3.5.2.2.1.6)*” to make it consistent with the further evaluation for detection of aging effect due to SCC for similar SRP-SLR Table 3.5-1, item 010.

SRP-SLR further evaluation Section 3.5.2.2.1.6 was revised as shown below to be consistent with Table 3.5-1, items 010, 038, and 039:

3.5.2.2.1.6 Cracking Due to Stress Corrosion Cracking

Stress corrosion cracking (SCC) of stainless steel penetration sleeves, penetration bellows, vent line bellows, suppression chamber shell (interior surface), and dissimilar metal welds could occur in ~~all types of~~ PWR and/or BWR containments. The existing program relies on ASME Section XI, Subsection IWE and10 CFR Part 50, Appendix J, to manage this aging effect. Further evaluation, including consideration of SCC susceptibility and applicable operating experience related to detection, is recommended of additional appropriate examinations/evaluations implemented to detect ~~these~~ this aging effect~~s~~ for these SS components and dissimilar metal welds.

SRP-SLR further evaluation Section 3.5.3.2.1.6 was revised as shown below to be consistent with Table 3.5-1, items 010, 038, and 039:

3.5.3.2.1.6 Cracking Due to Stress Corrosion Cracking

Further evaluation is recommended of programs to manage cracking due to SCC for stainless steel penetration sleeves, penetration bellows, vent line bellows, suppression chamber shell (interior surface), and dissimilar metal welds~~, and penetration bellows~~ in ~~all types of~~ PWR and/or 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~~ the listed SS components and dissimilar metal welds, considering SCC susceptibility and applicable operating experience (e.g., cracking of two-ply bellows) related to detection, 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.

The provision for supplemental surface examination in GALL-SLR Report AMP XI.S1 is intended to address detection of fatigue damage (cracking) due to cyclic loads aging effect/mechanism covered by AMR items in SRP-SLR Table 3.5-1, items 27 and 40, which are collectively intended to be the same as item 9 but for containment pressure-retaining components with no CLB fatigue analysis (i.e., the aging effect/mechanism is not managed by SRP-SLR Section 4.6 TLAA as for Table 3.5-1, item 009).

Supplemental surface examinations, in addition to code-based visual examinations, with capability to detect cracking is applicable for containment pressure-retaining boundary components based on considerations of cyclic loading (fatigue) and whether CLB fatigue analysis exists, and further evaluation of a plant-specific AMP or enhancement for SCC; with the alternate option of performing an appropriate leak rate test at least once every inspection interval and capable of detection of the aging effect, as was intended in the GALL Report Revision 2 and SRP-SLR. To avoid potential requests for additional information, the method proposed to be employed for specific components should be described with the basis for timely detection of the aging effect.

Consistent with the related AMP and AMR provisions in GALL Report Revision 2 and the SRP-SLR and GALL-SLR Report, supplemental surface examinations are recommended to detect cracking due to cyclic loading for steel, stainless steel (SS) and dissimilar metal weld pressure-retaining components that are subject to cyclic loading but have no CLB fatigue analysis (i.e., components covered by SRP-SLR Table 3.5-1, items 27 and 40, which is the same as item 9 but not managed by a CLB fatigue analysis TLAA, and corresponding GALL-SLR AMR items, as applicable to the plant). The components covered in these items may include penetration sleeves, penetration bellows, vent line bellows, suppression pool shell, dissimilar metal welds, metal liner, metal plate, personnel airlock, equipment hatch, and control rod drive (CRD) hatch with no CLB fatigue analysis, as applicable to the plant.

Further, the need for supplemental surface examination to detect cracking due to SCC is recommended for stainless steel and dissimilar metal weld components [e.g., components corresponding to SRP-SLR Table 3.5-1, item 10 (penetration sleeves and bellows), item 38 (suppression chamber shell inner surface), and item 39 (vent line bellows)] will be based on further evaluation of detection of aging effects, including consideration of susceptibility and applicable operating experience (e.g., two-ply bellows cracking) per SRP-SLR Section 3.5.2.2.1.6.

In principle, no new recommendations for supplemental surface examinations to address fatigue damage or SCC, than which already exists in related AMR items for which AMP XI.S1 is credited for aging management in GALL Report Revision 2 and SRP-LR, are being made in GALL-SLR Report or SRP-SLR. However, some changes are made in the AMP and related AMR items to ensure clarity in the AMP and/or to resolve inconsistency and component omissions between related AMR items in these existing guidance documents. The technical basis is the same as that documented collectively in sections/items that addressed the topic in NUREG–1950, "of Public Comments and Technical Bases for Changes in the License Renewal Guidance Documents NUREG–1801 and NUREG–1800." Refer to the following related sections/items in NUREG–1950, *taken collectively*.

1. For cracking due to cyclic loading with no CLB fatigue analysis: Table II-11, items II.B2.1.CP-107 (p II-268), II.B2.1-CP-142 (p II-284), II.A3.CP-37 and II.B4.CP-37 (p II-298), II.B1.1.CP-49 (p II-309), II.B2.2.CP-64 (p II-322); Table II-22, item XI.S1 ASME Section XI, Subsection IWE (p II-446 to II-448); Table IV-3, Comment 319 (p IV-25); Table IV-13, Comments 899 and 902 (p IV-277 to IV-279)

2. For cracking due SCC: Table II-11, items II.A3.CP-38 and II.B4.CP-38 (p II-301), II.B1.1.CP-50 (p II-309); Table IV-3, Comment 319 (p IV-25); Table IV-13, Comments 899 and 902 (p IV-277 to IV-279)

Where feasible, if an Appendix J leak test is used in lieu of recommended surface examination, the technical basis justifying an appropriate Appendix J test capable of early detection of fine cracks is provided in NUREG–1950, specifically Table II-11, items II.A3.CP-37 and II.B4.CP-37 (p II-298); II.A3.CP-38 and II.B4.CP-38 (p II-301); and Table II-22, item XI.S1 ASME Section XI, Subsection IWE (p II-446 to II-448). It is stated therein that visual examination may not detect fine cracks that may occur as a result of cyclic loading; therefore, supplemental surface examination is recommended. It is also stated therein that some penetration sleeves and bellows are not designed to allow for a local Type B pressure test, and that a Type A integrated leak rate test interval exceeding 10 years may not provide for early detection of cracking such that corrective actions are taken to prevent loss of primary containment leak-tightness. The related provision in the AMP that the type of leak test determined to be appropriate should be identified with the basis for components for which this option is used, is intended to avoid requests for additional information (RAIs) on this issue.

For AMR items corresponding to SRP-SLR Table 3.5-1, items 38 and 39, the indication of "No" in the further evaluation column in SRP-LR Revision 2 and GALL-SLR Report implied that the IWE program included supplemental surface examination (refer to technical basis for changes in NUREG–1950, Table II-11, item II.B1.1-CP-50 (p II-309), and Table IV-3, Comment 899 (p IV-277). However, in SRP-SLR and GALL-SLR Report, these items will have a further evaluation to be consistent with Table 3.5-1, item 10 with similar material, environment, and aging effect/mechanism.

The staff further notes that cumulative fatigue damage, which is the subject of the issue here, is an applicable aging mechanism/effect in the GALL-SLR Report and SRP-SLR for Class MC containment pressure-retaining components, including containment metal shell, penetration components, and metal liners of Class CC containments. For license renewal including SLR, this aging mechanism/effect can be addressed either through a time-limited aging analysis (TLAA), or by supplemental aging management method capable of detecting the aging effect. The ASME Code, Section III, Division 1 (incorporated by reference in 10 CFR 50.55a) or Section VIII, which are typically the code-of-record for metal containments, requires either a detailed fatigue analysis for cyclic operation or a fatigue waiver analysis considering cyclic loads over a design period, both of which qualify as a TLAA. The requirements of Section III, Division 1, are also invoked for liners in Division 2. Applicants for LR/SLR have the option to address the fatigue damage aging effect analytically through a TLAA to avoid having to manage the aging effect by alternate physical means such as supplemental surface or other enhanced examination methods capable of detecting fine cracks.

Comment: 046

XI.S1 ASME Section XI, Subsection IWE

4) Discussion of Mark I containment monitoring and trending implies that GL 87-05 required UTs at all drywells. However, if the Mark 1 containment design had a sealed sandbed, the GL and CLB did not require UTs to be performed.

Page # XI.S1-4, line 41; Element # 5, Monitoring; Page # XI.S1-5, line 8; Element #5, Monitoring

Description of Change:

Note that UTs may not have been required as part of the original license bases or the license basis during PEO.

Basis:

GL 87-05 does not require UTs if the sand bed is sealed.

Plants with Mark 1 containments with renewed licenses before GALL revision 2, may not have performed UTs depending upon their OE and original license basis with respect to GL 87-05.

With the current wording, an Exception is required to address the statement regarding past performance of UTs, since the past UTs were not required by GL 87-05 and the CLB for all Mark 1 containments.

RESPONSE:

The staff did not agree with the comment. An editorial change has been made to the related program element GALL-SLR Report AMP XI.S1, “ASME Section XI, Subsection IWE,” for better clarity and consistency with LR-ISG-2016-001, “Changes to Aging Management Guidance for Various Steam Generator Components.”

The staff revised AMP XI.S1 program element 5 per the markup below:

Source 019

5. *Monitoring and Trending*:

….The applicant should consider the following recommended actions based on plant-specific operating experience.

(a) Develop a corrosion rate that can be inferred from past ultrasonic testing (UT) examinations, if performed, or establish a corrosion rate using representative samples in similar operating conditions, materials, and environments. If degradation has occurred, provide a technical basis using the developed or established corrosion rate to demonstrate that the drywell shell will have sufficient wall thickness to perform its intended function through the subsequent period of extended operation.

(b) Demonstrate that UT measurements performed in response to NRC Generic Letter (GL) 87-05, "Request for Additional Information Assessment of Licensee Measures to Mitigate and/or Identify Potential Degradation of Mark I Drywells", if required, did not show degradation inconsistent with the developed or established corrosion rate.

The related statement in the "Monitoring and Trending" program element of AMP XI.S1 was revised as follows for better clarity and consistency with LR-ISG-2016-001:

> "The applicant should consider the following recommended actions based on plant-specific design and operating experience."

The language used in the AMP is intended to be consistent with that in the published LR-ISG-2016-001 that was incorporated into AMP XI.S1 of the GALL Report Revision 2. Subparagraph (a) does provide alternatives for developing a corrosion rate. While the staff recognizes that some Mark I containment designs may not have been required to perform or may not have performed UT in response to GL 87-05, LR-ISG-2016-001 stated that the recommended actions should be considered based on plant design and operating experience. Therefore, for better clarity, the related statement in AMP XI.S1 was revised to include consideration of plant-specific design. Specific situations of Mark I containments should be addressed as applicable on a case-by-case basis. The staff also notes from past LRA reviews that some licensees that did not perform UT in response to GL 87-05 for justified reasons, have performed UTs at a later date in support of their LRA or other reasons, such as operating experience.

Comment: 047

XI.S1 ASME Section XI, Subsection IWE

5) ASME subsection IWE-1240 only addresses areas subject to accelerated corrosion, i.e., areas where corrosion has been identified, and does not mention areas susceptible to accelerated corrosion.

Page # XI.S1-3, line 35 Element # 4, Detection

Description of Change:

Delete "or susceptible" after "subject to".

Basis:

The current wording does not reflect the IWE-1240 text.

The current wording is subjective and liable to result in regulatory uncertainty since there is no standardized definition that can be used to establish areas susceptible to accelerated degradation.

RESPONSE:

The staff partially agreed with this comment. The phrase "or susceptible to" has been deleted from the GALL-SLR Report AMP program element.

The staff revised lines 34–36 of the draft GALL-SLR Report, page XI.S1-3 in the Detection of Aging Effects program element of GALL-SLR Report AMP XI.S1, "ASME Section XI, Subsection IWE." as marked up below:

> ..inaccessible areas. IWE-1240 requires augmented examinations (Examination Category E-C) of containment surface areas subject to ~~*or susceptible to*~~ accelerated degradation. A VT-1 visual….

The related sentence in the Detection of Aging Effects program element on page XI.S1-3 of AMP XI.S1 is revised to read as follows to be consistent with that in the current IWE-1240:

> "IWE-1240 requires augmented examinations (Examination Category E-C) of containment surface areas subject to ~~or susceptible to~~ accelerated degradation <u>and aging</u>."

The subject wording in the AMP is intended to repeat the provision of IWE-1240; therefore, it should be consistent with that in the 2004 edition with 2006/addenda, and later editions/addenda of the ASME Code Section XI incorporated by reference in 10 CFR 50.55a, noting that earlier versions of the code used the phrase "likely to experience." It is further noted that there are situations that may require augmented examination where degradation may not have been identified yet but possible, such as that required by IWE-2313(2) or because of the environment the containment surface is subject to (e.g., moisture intrusion into containment shell or liner leak-chase channels).

<u>Comment</u>: <u>048</u>

XI.S2 ASME Section XI, Subsection IWL

1) Boling should be Boiler on page XI.S2-1, line #4, in the Program Description

RESPONSE:

The staff agreed with this comment and associated editorial change to the GALL-SLR Report has been made.

Source 019

<u>Comment</u>: **<u>049</u>**

XI.S2 ASME Section XI, Subsection IWL

2) Plant specific evaluations, when required, should be included as part of the applicable AMP instead of creating a separate program.

Page # XI.S2-1, after line 24, Program Description

Description of Change:

Revise Program Description to include plant-specific evaluations, when required, for concrete susceptible to freeze-thaw, leaching and carbonation, or reaction with aggregates mechanisms, or for increased temperatures of concrete structures. See items II.A1.CP-34 and II.A1.CP-147 as examples.

Basis:

The components in question would remain within the scope of the original AMP for managing aging effects outside of those requiring plant specific evaluations, so additional or modified inspection activities would likely be performed in conjunction with normal examinations. Recognizing this in the SRP, AMRs, and AMPs would provide the same enhanced inspections while minimizing duplications and reducing the need to address inconsistencies with GALL (Note E).

All of the concrete elements of the containments still have to be addressed as part of the IWL program in accordance with the ASME B&PV Section XI, Subsection IWL Code and 10 CFR 50.55a requirements for IWL. As currently written, there would be multiple programs, in addition to the IWL program, that would have to address aging effects of the containment concrete. This would unnecessarily complicate aging management activities and results in regulatory uncertainty regarding the content of these newly required, plant specific, aging management programs since the OE currently shows that the current IWL program requirements have been adequate to address containment concrete aging management activities. No relevant OE was identified to suggest that additional, long-term, on-going programs are required.

RESPONSE:

The staff did not agree with this comment. In general, the staff clarified that while the “aging effect” noted in the comment may or may not be covered for accessible areas under the scope of an existing AMP, the existing AMP is not specifically called out in the AMR items with a recommended further evaluation because the existing GALL-SLR Report AMP will not identify the aging effect (e.g., reduction of strength and modulus due to elevated temperature) and/or does not completely or adequately address the material, environment, and aging effect AMP combination for the component; and therefore, may need a plant-specific AMP based on the further evaluation. The term “plant-specific AMP” in the GALL-SLR Report and SRP-SLR is intended to mean a new plant-specific AMP or a plant-specific enhancement to the applicable existing programs to address these AMR items.

Comment: 050

XI.S2 ASME Section XI, Subsection IWL

3) Quantitative monitoring and trending requirements are too extensive to yield significant benefits for the additional costs incurred.

Page # XI.S2-3, lines 5 to 9, Element # 5, Monitoring

Description of Change:

In the first paragraph of Element 5, reword the third sentence to add “qualitative data” (this would then be consistent with XI.S6) and replace “all” with “significant findings for”.

Basis:

Recording and trending minor degradation is not necessary or effective in aging management of concrete. ACI 349.3R provides limits for categorizing degradation quantitatively and details further actions to be taken based on these limits. For aging effects that do not meet the minimum limits for which further action is required by ACI 349.3R, trending of size increases is not an effective aging management technique, e.g., shrinkage crack size or length. Degradation on this level must be recognized and addressed by qualified inspectors and evaluators. ACI 349.3R addresses this by specifying minimum qualifications for inspectors and evaluators.

The requirement to record and trend all data is unreasonable for every instance, however, miniscule and regardless of size. There will be considerable expense required to record and trend all individual indications, which cannot yield significant results since concrete exhibits minor imperfections as a result of original construction.

As currently worded, there is considerable uncertainty as to how compliance with this requirement could be demonstrated for a large structure, examined multiple times. It could be interpreted that each individual imperfection would have to be trended.

There is no Operating Experience to justify the additional level of precision of monitoring on either a one-time or a continuous basis.

This issue was previously identified as comment topic per 060415 NEI LTR.

It is unnecessary to specify recording, but we recommend recording and possibly photos only for more significant, indications greater than a certain size (such as ACI 349.3R Chapter 5 tier 2).

RESPONSE:

The staff did not agree with this comment. The staff’s intention was for monitoring and trending to occur for all significant findings. Significance is described by appropriate acceptance criteria outlined in Element 6. The acceptance criteria should be properly set for the program (see response to Comment 019-070) so that significant indications are identified. Indications that are identified by the program should be entered into the Corrective Action program element and receive a documented evaluation.

Source 019

<u>Comment</u>: **<u>051</u>**

XI.S2 ASME Section XI, Subsection IWL

4) New requirements for IWL Concrete Acceptance Criteria now specified to be quantitative per ACI 349.3R Chapter 5

Page # XI.S2-3, lines 20-23, Element # 6, Acceptance Criteria

Description of Change:

The acceptance criteria wording should be changed to be more in alignment with the wording in the XI.S6 AMP Element 6 for consistency.

Basis:

ASME Code and previous revisions of GALL placed the responsibility for determination of acceptability and/or acceptance standard for containment structural concrete with the Responsible Engineer. However, the need for established quantitative acceptance criteria is recognized. It is recommended that the wording of this element be more consistent with the wording of XI.S6 element 6 for concrete inspections for consistency.

The ACI 349.3R evaluation criteria provides guidance on the level of engineering review and evaluation of examination results should be performed to determine whether the concrete condition is acceptable, whether additional examinations are required, or whether repairs are required.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. Element 5 was revised to clarify this expectation. In addition, Element 6 was revised to indicate that indications that do not exceed the second-tier of American Concrete Institute (ACI) 349.3R are acceptable for concrete.

<u>Comment</u>: **<u>052</u>**

XI.S2 ASME Section XI, Subsection IWL

5) Corrective actions are not consistent with respect to terminology regarding conditions to be addressed as adverse conditions.

Page # XI.S2-3, lines 35, Element # 7, Corrective Actions

Description of Change:

The requirements should reflect the difference between conditions recorded as part of the IWL program, which would not be in CAP, and conditions that require repair and additional examinations, which would be entered into CAP.

Basis:

As currently worded, the requirements in elements 5, 6, and 7, could be inferred to require that all examination results, which exceed an ACI 349.3R tier 1 criteria, be entered into the corrective action program. There is regulatory uncertainty as to how sites would enter the very large amount of information into CAP. This would be an undue additional burden with no benefits since the current requirements in the GALL already require that examination results be recorded and evaluated, with repairs made as required. IWL already provides requirements on how to address examination results, including evaluation, additional examinations, repairs, and reporting.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. Element 5 was revised to clarify this expectation. In addition, Element 6 was revised to indicate that indications that do not exceed the second-tier of ACI 349.3R are acceptable for concrete. The staff's intention was for monitoring and trending to occur for all significant findings. Significance is described by appropriate acceptance criteria outlined in Element 6.

Comment: 053

XI.S3 ASME SECTION XI, SUBSECTION IWF

Description of Change and Justification:-

Page # XI.S3-1**,** Lines 7-10, "Program Description"

Description of Change:

Delete newly added sentence that refer to the IWL program and supplement requirements.

Justification:

Sentence refers to the wrong program and is redundant regarding supplement requirements.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made.

Comment: 054

XI.S3 ASME SECTION XI, SUBSECTION IWF

Page # XI.S3-1, Lines 28-30, "Program Description"; Page # XI.S3-2, Lines 37-39, Element 4-Detection; Page # XI 01-45, IWF program; SRP Page # 3.0-46, IWF program

Description of Change:

Program Description-Delete newly added sentence that refers to randomly selected additional supports for each group of materials used and the environments to which they are exposed outside of the existing IWF sample population.

Source 019

Element 4-Delete newly added clause in the 2nd sentence and new 3rd sentence that refer to randomly selected additional supports

Page # XI 01-47 and SRP Page # 3.0-47-Delete newly added sentence that refers to selected additional supports.

Justification:

This is beyond IWF Code requirements.

There is no relevant OE that was found as a basis for this new requirement.

Besides the cost to identify the new sample populations based upon materials and environments, randomly select the supports, perform the examinations (which would include support functions such as scaffolding and radiation protection), there will be a significant dose involved, depending upon the supports.

Class 3 supports are more numerous than Class 1 and Class 2 supports, and represent approximately one half of the total supports. Since 10% of the Class 3 supports are currently included within the scope of the examination sample, an additional 5% of the supports results in a 50% increase in the number of Class 3 supports to be examined, which is an almost 25% increase in the total number of supports to be examined. There is no relevant OE that has been found as a basis for such a large increase in scope, or for any increase in scope beyond the industry consensus IWF sampling scope.

Hundreds of supports are already examined per site. An increase of 5% is not statistically warranted and there is no technical basis for such a scope increase. The IWF Code section IWF-2430 contains requirements for “Additional Examinations” which detail scope increase requirements for examination of additional supports when flaws or relevant conditions exceeding acceptance standards are identified in the supports examined.

In addition, there are also other programs that perform general walkdowns in the affected areas that will identify changes in conditions such as significant losses of material which include plant tours by operations personnel, Boric Acid Corrosion area inspections, and External Surfaces inspections.

The original IWF program required periodic examinations of 100% of the supports and the requirement for 100% examination was abandoned. The sampling mentioned in lines 15-20 on page XI.S3-1 was developed due to the excessive costs and dose, and lack of OE that warranted a larger sample size.

By the time of SLR, the supports will have been in place for 60 years, with continuous performance of current IWF examinations, allowing for identification of problematic supports, so sample expansion is not required during SLR.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made.

In particular, for GALL-SLR Report AMP XI.S2, "ASME Section XI, Subsection IWL," Element 4, the staff clarified that the additional five percent refers to five percent of the current inspection sample size, not an additional five percent of all IWF supports. The staff added wording that indicates it is a one-time inspection, conducted within 5 years prior to entering the subsequent period of extended operation. In addition, the staff added wording that the inspection of additional supports should include the components that are the most susceptible to degradation.

In the examples for the FSAR Supplement, the staff added the words one-time regarding the inspection of additional supports.

The population of supports that are currently inspected in accordance with 10 CFR 50.55a include the same supports each inspection interval. This nominal increase allows that supports that have never been inspected can be verified to be representative of the entire population of supports, or could identify aging that is occurring in supports that have never been inspected during the life of the plant. Although other programs, walkdowns, or inspections could potentially identify age-related degradation of IWF supports, they may not, or issues may not be dispositioned appropriately to the IWF AMP. Operating experience should be an important consideration in determining the need for additional activities for the 60–80 year period; however, the sample chosen at the time the IWE Code was implemented in accordance with 10 CFR 50.55a, the sample selection required by ASME did not necessarily consider different aging mechanisms and effects necessary to be covered by aging management under 10 CFR Part 54. Addition of a select number of random inspections and inclusive of aging effects or environment most susceptible to degradation allows for better assurance that the IWF AMP sample will be representative of the aging of the entire component support population during the subsequent period of extended operation.

Comment: 055

XI.S3 ASME SECTION XI, SUBSECTION IWF

Page # XI.S3-1, Line 32, Element 1-Scope; Page # XI.S3-2, Line 36, Element 4-Detection

Description of Change:

Element 1-Restore the clause that limited the scope to supports not exempt from examination and delete the newly added, last sentence of the section that addresses inaccessible supports.

Element 4-Add clarification from Table IWF-2500-1 note regarding multiple components, other than piping, within a system of similar design, function, and service, that the supports of only one of the multiple components are required to be examined.

Justification:

This is beyond IWF Code requirements.

Supports are exempted from examination by the Code when the piping or components themselves are exempt from examination or if the supports are inaccessible (IWF-1230). If the piping or component is exempt from examination, examination of the previously exempt supports is expected to provide negligible benefits with regards to aging management. Note that the ASME section XI, IWB/IWC/IWD AMP does not add into scope the examination of exempt piping or components.

Source 019

This is an examination program of accessible supports and there are no provisions in the current Code to address the evaluation of acceptability of inaccessible supports. This results in the potential for significant regulatory uncertainty during NRC inspections of this requirement.

There is no applicable OE that was found as a basis for this new requirement. Besides the cost to identify the supports that are exempt but accessible, perform the examinations (which would include support functions such as scaffolding and radiation protection), there will be a significant dose involved, depending upon the supports.

As an example of a similar requirement, the original IWF Code required removal of insulation to allow for examination of pipe clamps. This requirement to make the clamps accessible was subsequently deleted due to the excessive costs and dose, and lack of negative OE.

By the time of SLR, the supports will have been in place for 60 years, so inclusion of supports previously exempt from examination is expected to provide negligible benefits with regards to aging management.

Inaccessible component supports that support active components are indirectly monitored through the Maintenance Rule required vibration monitoring of the active components.

RESPONSE:

The staff did not agree with this comment. The GALL-SLR Report has not been changed.

The program recommends that acceptability be evaluated for inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in degradation to such inaccessible areas. An evaluation can be qualitative and does not necessarily mean that inaccessible areas must be accessed. Accessible areas could be leading indicators to trigger an investigation of similar inaccessible areas, as applicable on a plant-specific basis. The change was not intended to mean that applicants are expected to expand the scope of regular inspections to components exempted by the ASME Section XI, Subsection IWF requirements, but that there be an evaluation for inaccessible components if conditions in accessible components indicate unacceptable age-related degradation may be occurring.

This is expressly stated in ASME Code Section XI, Subsection IWF, as incorporated by reference in 10 CFR 50.55a, and therefore repeating the existing requirements (Table IWF-2500-1 note regarding multiple components, other than piping, within a system of similar design, function, and service, that the supports of only one of the multiple components are required to be examined) is not necessary.

<u>**Comment**: **056**</u>

XI.S3 ASME SECTION XI, SUBSECTION IWF

Page # XI.S3-1, Line 25, Program Description; XI.S3-1, Line 34, Element #1-Scope; XI.S3-2**,** Lines 7, Element 2- Preventive;

<u>Description of Change</u>:

Delete the requirement for actual measured yield strengths and change to expected yield strengths.

Justification:

Actual strengths may not have been required to be submitted with material deliveries for support bolts until late in the construction phases of the nuclear power plants as a result of Code changes and may not now be traceable to individual installed bolts at older plants. NUREG–1950 has an explanation of the OE regarding support bolts that does not involve a strict acceptance criteria at exactly 150 ksi.

RESPONSE:

The staff did not agree with this comment. The GALL-SLR Report has not been changed. The staff considers it appropriate to address this on a plant-specific basis for plants that are unable to retrieve information regarding actual strengths.

Comment: 057

XI.S3 ASME SECTION XI, SUBSECTION IWF

Page # XI.S3-2**,** Line 21, Element 3-Parameters;

Description of Change:

Delete cracking of welds from the list of parameters.

Justification:

Cracking of welds is not included in the Code under IWF-3410.

Cracking of welds is not included under element #6.

There is no applicable OE that was found or cited as a basis for this new requirement.

The IWF program uses VT-3 examinations and is generally not credited with detecting cracks, even though ISI examiners would typically identify cracks in welds if observed. However, the visual acuity requirements are not currently consistent with other Code sections where cracks are detected visually.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. These consisted of the removal of the words “cracking of” in the Element 1; and adding wording to Element 3 …general structural condition of weld joints and weld connections to building structure for loss of integrity.

The staff agreed with comment that the IWF VT-3 examinations are not credited with detecting cracks. However, the staff did not agree that the AMP should delete mention of welds. It is expected that welded connections will be inspected for general structural condition observable by general visual and VT-3 examinations.

Source 019

Comment: 058

XI.S3 ASME SECTION XI, SUBSECTION IWF

Page # XI.S3-2**,** Lines 28 and 29, Element 3-Parameters;

Description of Change:

Delete “concrete around anchor bolts” is monitored for cracking from the list of parameters.

Justification:

Cracking in concrete is not included within the scope of IWF. Concrete examination qualification requirements and acceptance criteria are not addressed. This results in potential regulatory uncertainty with respect to future NRC inspections.

Cracking of concrete at anchors is not included under element #6.

There is no applicable OE that was found as a basis for this new requirement.

The IWF program uses VT-3 examinations and is generally not credited with detecting cracks in concrete, even though ISI examiners would typically identify significant cracks in concrete if observed.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. The staff added wording to clarify that cracking of concrete around anchor bolts is managed by the Structures Monitoring aging management program (AMP).

Comment: 059

XI.S3 ASME SECTION XI, SUBSECTION IWF

Page # XI.S3-2, Line 26, Element 3-Parameters; Page # XI.S3-3, Line 6, Element 4-Detection

Description of Change:

Clarify that not all bolts for all supports require examination.

Justification:

As currently written, there is uncertainty between the statements that refer to supports within the sample population to be examined and statements regarding bolt examinations that are not limited with respect to scope of examination. This results in potential regulatory uncertainty.

The Code does not require inspection of all bolts.

There is no applicable OE that was found as a basis for this new requirement. Besides the cost to identify the new sample populations based upon materials and environments, randomly select the supports, perform the examinations (which would include support functions such as scaffolding and radiation protection), there will be a significant dose involved, depending upon the supports.

There are other programs that perform general walkdowns in the affected areas that identify changes in conditions and significant losses of materials such as plant tours by operations personnel, BAC, and External Surfaces.

The original IWF program required periodic examinations of 100% of the supports and the requirement for 100% examination was abandoned. The sampling mentioned in lines 15-20 on page XI.S3-1 was developed due to the excessive costs and dose, and lack of negative OE.

By the time of SLR, the supports will have been in place for 60 years, with continuous performance of current IWF examinations, allowing for identification of problematic supports, so sample expansion, which is not based upon plant specific OE or Code changes is not required during SLR.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. In Element 3, the staff removed “all” in the sentence referring to the parameters monitored for bolting.

It is not intended that visual inspection be performed on 100 percent of ASME support bolting be inspected. If there is bolting included within the scope of the IWF program as-is, and it is representative of the age-related degradation of the remaining population, the program is sufficient to perform the inspections on components already within the program or included in the additional one-time inspection of five percent of components inspected under SLR. The Responsible Engineer for ensuring aging management of IWF component supports should evaluate the need to include additional bolting if necessary.

Comment: **060**

XI.S3 ASME SECTION XI, SUBSECTION IWF

Page # XI.S3-2, Line 30 and 31, Element 3-Parameters; Page # XI.S3-3, Lines 7-10, Element 4-Detection

Description of Change:

Element 3-Delete phrase referring to volumetric examination of A325 and A490 bolts. Add sentence from Structures Monitoring program that addresses OE for A325 and A490 bolts.

Element 4-Delete sentence referring to volumetric examination of A325 and A490 bolts.

Justification:

There is an inconsistency in addressing A325 and A490 bolts between XI.S3 and XI.S6 programs that was addressed in NUREG–1950, comment # 906.

There is no applicable OE that was found as a basis for this requirement. Besides the cost to identify the bolts and perform the examinations (which would include support functions such as scaffolding and radiation protection), there will be a significant dose involved, depending upon the supports.

Source 019

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made as follows:

1. The staff modified the wording in Element 4 to clarify that all high-strength bolting is subject to volumetric examination unless a plant-specific justification is provided.

2. The staff removed specific mention of ASTM A325 bolting

SCC is an applicable aging effect for high-strength bolting (actual measured yield strength greater than or equal to 150 ksi or 1034 MPa) in sizes greater than 1 inch nominal diameter in ASME Code applications, and therefore retained in GALL-SLR Report AMP XI.S3, “ASME Section XI, Subsection IWF.” There is relevant operating experience in EPRI NP-5769, Vol 1 (“Degradation and Failure of Bolting in Nuclear Power Plants”) of brittle failure of NSSS support bolting due to SCC, and the staff position is that for aging management, high-strength bolts with the properties described above that are included in ASME IWF applications, volumetric examinations should be performed for a sample of the bolts to determine whether cracking due to SCC has occurred. Note, this is not a change from the previous recommendation, it is a clarification that bolts meeting the criteria are subject to volumetric examination. The staff removed specific mention of ASTM A325 bolts because it is not likely that ASTM A325 bolting meeting the criteria is used. Also note that volumetric examinations may be waived with adequate plant-specific justification. This plant-specific justification would need to consider the population of high-strength bolts in IWF supports and determine on a component basis whether SCC is a credible aging effect. An example could include a detailed evaluation of SCC susceptibility with verification of a non-corrosive environment, and/or a one-time volumetric examination to confirm SCC is not occurring. A490 bolts are not considered exempt from volumetric examination on a material basis alone.

Comment: 061

XI.S3 ASME SECTION XI, SUBSECTION IWF

Page # XI.S3-4**,** Lines 41, Element 10-Operating Experience;

Description of Change:

Refer to NUREG–1950, comment # 906, when characterizing the aging of bolts.

Justification:

Comments in NUREG–1950 address aging of bolts mentioned in the other documents.

RESPONSE:

The staff did not agree with this comment. The GALL-SLR Report has not been changed.

Comment: **062**

XI.S3 ASME SECTION XI, SUBSECTION IWF

Page # XI.S3-4**,** Lines 42 and 43, and XI.S3-5, Lines 1-3, Element 10-Operating Experience;

Description of Change:

Delete reference to IN 2009-04

Justification:

This OE refers to wear on the linkages and increased friction between the various moving parts and joints within the constant support, which are elements not within the scope of examination of passive components under SLR at one specific site with unusually high vibration.

RESPONSE:

The staff did not agree with this comment. The GALL-SLR Report has not been changed. The staff considers this unnecessary - if the OE does not apply to the plant, it is dispositioned in accordance with the process for consideration and application of INs per the corrective action program and Element 10 of the AMP.

Comment: **063**

XI.S4 10 CFR Part 50, Appendix J

Description of Change and Justification (Basis):

1. Program Description, page XI.S4-1: Clarify that Type B tests are not performed on components for which Type C tests are applicable.

2. Program Description, page XI.S4-1: Delete sentence discussing Type C testing being performed under a different AMP. GALL identifies AMPs other than Appendix J to manage the aging of pressure boundaries. NUREG–1801 Chapter V.C identifies aging management programs for mechanical containment isolation components. The introduction to NUREG–1801 Chapter V.C notes that containment isolation valves for in-scope systems are addressed in the appropriate Section in IV, VII and VIII. The listing of the mechanical containment isolation component AMPs by the Appendix J AMP would be redundant and unnecessary. Use of the process to identify redundant program testing/examination coverages was not intended by NEI 95-10 or 10 CFR 54.

3. Element 1, page XI.S4-2: Delete the requirement in AMP XI.S4 element 1 to identify other SLR AMPs for components that are not managed for aging by AMP XI.S4. For justification, see comment 2 above. (Comment was previously addressed as a comment in attachment to NEI Letter to NRC dated 06-04-15.)

RESPONSE:

The ordered list below includes multiple NRC responses. The staff partially agreed with the comments as follows:

Source 019

1. The GALL-SLR Report AMP XI.S4, “10 CFR Part 50, Appendix J,” language parallels that used in regulations. “Type B (containment penetration leak rate) tests detect local leaks and measure leakage across each pressure-containing or leakage-limiting boundary of containment penetrations.” Appendix J of 10 CFR 50 clearly states what Type B tests do. There is no discussion of Type C testing in the referenced sentence of regulations.

2. Staff agreed with the comment in part. The staff deleted the sentence discussing Type C testing being performed under a different AMP. However, the notion that the GALL-SLR Report identifies AMPs other than Appendix J to manage the aging of effects of pressure boundaries; and therefore, their listing is redundant and unnecessary, is addressed in Part (c), below.

3. The insertion of Type B or C testing is accepted as it clarifies the type of the testing. For the suggested deletion of listing of the mechanical AMPs, the staff agreed there are a number of AMPs and/or TLAAs that could support the management of aging effects of the excluded pressure boundary components. However, it is important the applicant identifies the basis for the exclusion and the applicable AMPs and/or TLAAs for the staff to evaluate the adequacy of these for reasonable assurance that the prevalent aging effects are managed and the integrity of the containment pressure boundary is maintained during the subsequent period of operation.

Comment: 064

XI.S5 Masonry Walls

Description of Change and Justification (Basis):-

1. Element 4, page XI.S5-2: Use the 5 year frequency for all masonry walls. The new frequency requirement for inspection every 3 years for unbraced and unreinforced masonry walls is unsupported by operating experience and it is therefore unnecessary. In addition, it is also unnecessarily prescriptive since the Element 4 sentence immediately following the subject 3-year frequency sentence notes that provisions exist for more frequent inspections based on the significance of observed conditions such as cracking, loss of material, or other degradation. (Comment was previously addressed as a comment in attachment to NEI Letter to NRC dated 06-04-15.) In addition, during a public meeting on this topic on February 19, 2016 the NRC representative stated that the draft change to the 3 year frequency was based on the 1 year preventative maintenance inspection (by maintenance personnel) recommendation in NCMA TEK 8-1A. NMCA TEK 8-1A (2004) is not a code or standard, but it is rather an informational series document detailing preventative maintenance recommendations to commercial facility owners. It is not applicable to nuclear power plants. However, on page 5 of the NCMA document it recommends “Masonry or building specialists should be consulted for a more thorough inspection every five years.” The five year inspection frequency is consistent with our Structures Monitoring and Masonry Wall program inspections by trained and qualified personnel conducted every five years.

2. Element 6, page XI.S5-2: Remove the statement recommending inspection of safety related equipment near or adjacent to masonry walls as it is unclear as to purpose. Program elements 3 and 4 do not address these equipment inspections which are outside of the scope of the Masonry Walls Program and element 6 does not address acceptance criteria for such equipment inspections. The new recommendation or requirement in the

Acceptance Criteria Element states: "Safety-related equipment near or adjacent to masonry walls should be inspected to ensure the affected masonry walls are being properly managed for aging." This statement does not make sense in the context of inspecting the nearby equipment rather than inspecting the subject walls. This appears to be a scoping methodology issue which would be inappropriate or unnecessary to include in an aging management program.

3. Generic Efficiency Comment–previously made: Consider combining the XI.S5 Masonry Walls and XI.S6 Structures Monitoring programs since masonry walls are a structural feature or structural component which is a subset of the other structural components which make up a given structure and since masonry walls are typically included in the existing Structures Monitoring programs and procedures of most plants. (Previous NEI comment included with NEI Letter to NRC dated 8-06-14 (No markup provided below)

4. Elements 5 and 6, page XI.S5-2: See also generic comment under IWL regarding monitoring and trending, and markup below. Measurement and recording dimensions and trending of visual indications however infinitesimal is not reasonable and provides no value. Similarly it is not reasonable or necessary to perform a formal technical evaluation to technically justify every indication however small or infinitesimal that can be observed. Trending is adequately performed by comparison to previous results, therefore the word trending can be replaced by the words comparison to previous results as also stated in these elements.

RESPONSE:

The staff agreed with Parts 1 and 2 of the comment. The staff did not agree with Parts 3 and 4.

Part 1: The frequency of inspections was changed to 5 years with the potential for more frequent inspections in areas where significant loss of material, cracking, or other signs of degradation are observed.

Part 2: The statement in Element 6 was updated to delete the statement "Safety related equipment near or adjacent to masonry walls should be inspected to ensure the affected masonry walls are being properly managed for aging."

Part 3: No change - see response for Comment 019-018.

Part 4: See updated wording in GALL-SLR Report AMP XI.S5, "Masonry Walls," Elements 5 and 6. Also see response to Comments 019-070 and 019-073.

Comment: 065

XI.S6 Structures Monitoring

Description of Change and Justification (Basis):

Program Description, page XI.S6-1 & Element 4, page XI.S6-3:

Clarify the requirement for supplemental inspection of high-strength structural bolting to exclude ASTM A325 and ASTM A490 bolts (including equivalent twist-off type F1852 and F2280 bolts).

This has been done at the end of Element 3 and similar wording is recommended here in Element 4. This will resolve the apparent contradiction between Elements 3 and 4.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The staff has removed the recommendation related to stress corrosion cracking of high-strength bolting from the structural GALL-SLR Report AMPs XI.S6, "Structures Monitoring," and GALL-SLR Report XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," and deleted associated AMR items.

All bolts within the scope of structural AMPs XI.S6 and XI.S7 receive a general visual inspection. Common high-strength bolt materials have not been shown to be prone to SCC in standard civil structural applications; therefore, generic guidance on SCC for high-strength bolts in civil structural applications is unnecessary. SCC could still be a concern for high-strength bolting in ASME Code applications; therefore, the recommendation has been retained and clarified in GALL-SLR Report AMP XI.S3, "ASME Section XI, Subsection IWF." Removing the guidance from the structural AMPs XI.S6 and XI.S7 improves clarity.

Comment: 066

XI.S6 Structures Monitoring

Description of Change and Justification (Basis):

Program Description, page XI.S6-1 & Element 3, page XI.S6-2:

Coatings should not be monitored and inspected as part of this program, except when specifically relied upon to manage specific aging effects for specific structures in the scope of license renewal. The parameters described in Element #3 would generally not provide any indication of the underlying condition of the underlying material except for paint blisters in coatings on carbon steel that are caused by the build-up of corrosion products. Coatings are applied to many different types of materials, including non-ferrous materials, concrete, and masonry walls, where the coating condition will provide little, if any, indication of the underlying material. To include the monitoring and trending of all the various types of coatings applied to all underlying materials, in all structures within the scope of license renewal, is an undue burden that would not be used as a basis for evaluation of the underlying material. In addition, the monitoring would require the development of quantitative acceptance, for all of the various coating systems and applications on the various materials, environmental exposure conditions, and various structures, which are generally not developed since the coatings do not currently have an intended function.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. To clarify that coatings themselves are not within the scope of this program, unless they have an intended function, discussion of coatings was removed from the program description and wording was added to Element 1. The wording in Element 3 was revised to make it clear the coating is only inspected for signs of distress in the underlying material.

The staff agreed that coatings are generally not within the scope of license renewal and do not serve an intended function. However, many structures within the scope of license renewal are coated and still require a visual inspection. The intent of the proposed wording was to make it clear that coated structures within the scope of license renewal require a visual inspection regardless of whether or not the coatings are within scope. The staff did not intend for quantitative acceptance criteria to be developed for coatings; unless they have a license renewal intended function.

Comment: 067

XI.S6 Structures Monitoring

Description of Change and Justification (Basis):

Elements 3 and 4, pages XI.S6-2, -3, and -4:

Delete requirement to monitor all through-wall leakage of groundwater for volume and chemistry. We are not aware of any OE where groundwater in-leakage has resulted in age related degradation that has resulted in a loss of intended function. Monitoring through-wall leakage of groundwater for volume and chemistry is not feasible in cases of slight seepage, or for cases of leakage from multiple sources either closely or widely spaced, or in cases of intermittent leakage. Under existing programs, any through-wall leakage or groundwater infiltration that is identified is evaluated to determine appropriate further actions. Existing programs include evaluation of leaching to determine if it has resulted in an increase in porosity and permeability sufficient to cause a structurally significant loss of strength. Potential effect of aggressive groundwater is also evaluated. Monitoring for volume and chemistry of leakage water is an option that may be included in these evaluations, if determined appropriate by engineering. However, at present there is no established information available for correlation or evaluation of any data obtained which could be used to assess the data and the concrete physical condition. Recommending and effectively requiring utilities to gather and evaluate such data results in regulatory uncertainty.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The discussion in Element 4 regarding corrective actions was replaced with wording recommending an assessment of possible aging effects caused by groundwater in-leakage. Additionally, the word “may” was added to the guidance in Element 4 related to what information should be included in the assessment.

Requiring monitoring of volume and chemistry is not overly prescriptive. There is significant operating experience from recent license renewal application reviews with licensees finding through-wall leakage acceptable as-is with little or no evaluation. The staff does not consider through-wall leakage acceptable and expects some form of assessment to be completed when leakage is identified. Furthermore, the staff did not agree that monitoring the leakage is not feasible and that monitoring does not provide useful data. Significant changes in the volume or chemistry data of the leakage could be a leading indicator of concrete or reinforcing steel degradation. The guidance allows licensees to determine the appropriate parameters monitored along with the frequency of the monitoring and to determine what additional actions need to be taken based on the results of monitoring.

Source 019

<u>Comment</u>: <u>068</u>

XI.S6 Structures Monitoring

<u>Description of Change and Justification (Basis)</u>:

Element 4, page XI.S6-3:

Delete requirement for seasonal variations in groundwater sampling. The recommendation for seasonal quarterly or semi-annual evaluations of ground water is too prescriptive on a generic basis and would not be necessary or effective. Seasonal variations may occur for specific plants, such as cold weather plants that utilize de-icing salts, but each plant should determine when and where to sample groundwater to assess any potential effect on in-scope structures. The existing 5 year frequency from NUREG–1801 should be maintained in the SLR GALL.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The wording in Element 4 has been revised to make it clear that groundwater monitoring only has to be done every 5 years, but when done, the monitoring should account for seasonal variations.

The staff agreed that a 5 year frequency is appropriate to monitor groundwater. However, the staff did not agree that seasonal variations should be accounted for on a plant-specific basis. All plants may experience seasonal variations in groundwater chemistry, and the sampling is used to identify the possible variation.

<u>Comment</u>: <u>069</u>

XI.S6 Structures Monitoring

<u>Description of Change and Justification (Basis)</u>:-

Element 4, page XI.S6-4:

Delete requirement for inspecting inaccessible concrete structural elements exposed to aggressive groundwater/soil on an interval not to exceed 5 years. This is a prescriptive action that may be unnecessarily burdensome and appears to remove engineering flexibility from the licensee. Other alternatives, such as core boring, examination of other buried/submerged concrete surfaces exposed to similar or more aggressive ground water, or analysis should also be considered. OE does not reflect the need for the new requirement to make inaccessible concrete accessible for inspection when exposed to aggressive groundwater. Also, much of the buried concrete is protected by water-proofing membranes that could easily be damaged during the excavation, leaving the concrete exposed to a harsher environment.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The wording in Element 4 has been revised to allow more flexibility in the actions taken when concrete is exposed to aggressive groundwater.

The staff agreed that the recommendation may be overly prescriptive and burdensome. Licensees should be allowed the flexibility to decide the best method for managing their inaccessible concrete. However, the staff believes the evaluation and any associated actions should occur every 5 years.

Comment: 070

XI.S6 Structures Monitoring

Description of Change and Justification (Basis):

Element 5, page XI.S6-4:

Limit recording and trending to significant findings for applicable parameters monitored or inspected. Recording and trending may be unreasonable for minor degradations.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. Element 5 was revised to clarify this expectation. Element 6 was also revised to indicate that indications that do not exceed the second-tier of ACI 349.3R are acceptable for concrete. The staff's intention was for monitoring and trending to occur for all significant findings. Significance is described by appropriate acceptance criteria outlined in Element 6.

Comment: 071

XI.S6 Structures Monitoring

Description of Change and Justification (Basis):

Element 5, page XI.S6-4:

Quantitative baseline inspection data should not need to be established prior to SLR. Prior to the GALL Revision 2, the recording of quantitative inspection data was not always a requirement at all of the plants granted renewed licenses for all parameters, components, and aging effects within the scope of the program. No relevant OE is cited as a basis to backfit this requirement for all plants for all parameters, components, and aging effects. This backfit is an undue burden to generically require that the baseline be developed prior to SLR for all plants for all parameters, components, and aging effects within the scope of the program. A need to develop baseline data prior to SLR could be verified during the RAI of the SLR process as a result of specific OE for specific plants, for specific parameters, components, and aging effects.

Provide the option of crediting existing baseline inspections that meet the GALL-SLR Report criteria. Plants that can show documented baseline inspection results that meet the new criteria should not have to repeat the baseline inspection.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. Element 5 was revised to credit existing inspection data to establish a baseline.

Source 019

The staff did not agree that requiring a baseline inspection prior to the period of subsequent license renewal is a backfit or an undue burden. Quantitative inspection criteria are necessary to ensure all indications are identified and treated similarly regardless of the inspector or reviewer. At least one inspection should be completed with these criteria prior to entering SLR so licensees can properly monitor and trend inspection results throughout the SLR period. The staff agreed that existing inspection data can be credited for this baseline if the inspections were conducted with appropriate SLR acceptance criteria.

Comment: 072

XI.S6 Structures Monitoring

Description of Change and Justification (Basis):

Element 4, page XI.S6-3:

The wording added for NDE should be clarified as it could be viewed as prescribing the use of any NDE that is appropriate, or conversely justifying why it is inappropriate to include the use of a certain NDE technique. These potential interpretations could also result in regulatory uncertainty. Structures Monitoring is a visual examination and monitoring program which could include the use of NDE (such as hammer sounding or other techniques) if and when determined necessary or useful by engineering. Visual inspection is also the primary method for concrete inspection under ACI 349.3R, supplemented by non-destructive examination, and invasive examination and testing if deemed necessary by engineering.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. The added statement was deleted from Element 4.

The staff did not agree that requiring a baseline inspection prior to the period of subsequent license renewal is a backfit or an undue burden. Quantitative inspection criteria are necessary to ensure all indications are identified and treated similarly regardless of the inspector or reviewer. At least one inspection should be completed with these criteria prior to entering SLR so licensees can properly monitor and trend inspection results throughout the SLR period. The staff agreed that existing inspection data can be credited for this baseline if the inspections were conducted with appropriate SLR acceptance criteria.

Comment: 073

XI.S6 Structures Monitoring

Description of Change and Justification (Basis):

Element 7, page XI.S6-4:

The requirements should reflect the difference between conditions recorded as part of the Structures Monitoring program, which would not be in CAP, and conditions that require repair or replacement, and additional examinations, which would be entered into CAP. Basis: As currently worded, the requirements in elements 3, 4, 5, 6, and 7, could be inferred to require that all examination results, such as those that exceed an ACI 349.3R tier 1 criteria or coating imperfections, be entered into the corrective action program. There is regulatory uncertainty as to how sites would enter the very large amount of information into CAP. This would be an undue additional burden with no benefits since the current requirements in the GALL already require that examination results be recorded and evaluated, with repairs made as required.

Specifically for concrete, visual inspections of concrete are viewing the concrete cover of the structure. Concrete aging mechanisms visible in the concrete cover have a non-linear affect on containment intended functions. Examination results of small imperfections such as fine cracks, pop-outs, etc., of structures at least 60 year old, do not provide any information that directly relates to an impact on structural integrity until there is significant degradation, e.g., large spalls, cracks that exhibit the potential for displacement, and measurable corrosion of reinforcing steel, that can be repaired. As a result, small imperfections such as fine cracks, pop-outs, etc., of structures at least 60 year old cannot provide information that can be used to determine a significant impact on structural capacity or result in a change to aging management. Entering the CAP for insignificant imperfections of the concrete cover will result in an undue burden, while not providing relevant information that could be used to evaluate the integrity of the structures. A similar rationale applies to coating conditions.

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed. The acceptance criteria should be properly set for the program (see response to Comment 019-070) so that significant indications are identified. Indications that are identified by the program should be entered into the Corrective Action program element and receive a documented evaluation.

Comment: 074

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Program Description, page XI.S1:

Plant specific evaluations for concrete susceptible to freeze-thaw, leaching and carbonation, aggregate reaction mechanisms, or increased temperatures of concrete structures are included in this AMP, if applicable. There is no reason to require a separate AMP for these aging effects that can be adequately assessed on the accessible side of inaccessible concrete by the XI.S7 AMP.

RESPONSE:

The staff did not agree with this comment. The GALL-SLR Report has not been changed. The staff did not intend applicants to be forced to create plant-specific AMPs. The proposed change was intended to improve consistency across the guidance documents; however, the staff acknowledges the changes may have introduced additional confusion. Therefore, the wording in SRP-SLR Table 3.5-1 was revised to make it clear that further evaluation is needed to determine if a plant-specific AMP is necessary.

The staff disagreed that a plant-specific AMP should be completely removed and these aging effects should be addressed within AMP XI.S7. The associated SRP-SLR further evaluation sections make it clear that a plant-specific AMP is only necessary if the aging effects are determined to be significant. Without this, no additional plant-specific AMP is necessary.

Even if the evaluation indicates a plant-specific AMP may be warranted, applicants have the option of enhancing their existing programs to address this aging effect if that is the appropriate approach. This would need to be identified and explained in the further evaluation section and the AMP in the SLRA.

Comment: 075

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Element 4, page XI.S7-3:

Remove requirement that RG 1.127 inspections be conducted under direction of licensed professional engineers as this requirement is unnecessarily limiting and not in alignment with RG 1.127. No operating experience or technical basis founded on aging lessons learned is cited for this change.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. This was inappropriately added to the guidance. Requiring the inspections be conducted under the direction of a professional engineer is beyond the requirement in the other structural AMPs and beyond the guidance in RG 1.127. The AMP was updated to remove the requirement of a licensed professional engineer.

Comment: 076

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Element 4, page XI.S7-3:

Remove the requirement for frequency of raw water and ground water chemistry evaluation to identify seasonal variations. This constitutes a significant frequency change and is unnecessarily prescriptive. See also comments on groundwater monitoring addressed for XI.S6.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The wording in Element 4 has been revised to make it clear that groundwater monitoring only has to be done every 5 years, but when done, the monitoring should account for seasonal variations.

The staff agreed that a 5-year frequency is appropriate to monitor groundwater. However, the staff disagreed that seasonal variations should be accounted for on a plant-specific basis. All plants may experience seasonal variations in groundwater chemistry, and the sampling is used to identify the possible variation.

Comment: 077

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Element 4, page XI.S7-3:

The requirement for supplemental inspection of high-strength structural bolting should be clarified to exclude ASTM A325 and ASTM A490 bolts (including equivalent twist-off type F1852 and F2280 bolts). This has been done at the end of Element 3 and similar wording is recommended here in Element 4. This will resolve an apparent contradiction between Elements 3 and 4.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The staff has removed the recommendation related to SCC of high-strength bolting from the structural GALL-SLR Report AMPs XI.S6, "Structures Monitoring," and GALL-SLR Report AMP XI.S7, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," and deleted associated AMR items.

All bolts within the scope of structural AMPs XI.S6 and XI.S7 receive a general visual inspection. Common high-strength bolt materials have not been shown to be prone to SCC in standard civil structural applications; therefore, generic guidance on SCC for high-strength bolts in civil structural applications is unnecessary. SCC could still be a concern for high-strength bolting in ASME Code applications; therefore, the recommendation has been retained and clarified in GALL-SLR Report AMP XI.S3, "ASME Section XI, Subsection IWF." Removing the guidance from the structural AMPs XI.S6 and XI.S7 improves clarity.

Comment: 078

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Element 4, pages XI.S7-3:

The new requirements for inspection of submerged concrete subject to nonaggressive raw water or plant specific justification for acceptability of submerged concrete if inspections do not occur within the 5 year interval appears to be overly prescriptive and unnecessarily removes flexibility from the licensee. In addition, no OE has been identified that would require such examinations for all plants at that frequency.

RESPONSE:

The staff did not agree with this comment. The GALL-SLR Report has not been changed.

The staff does not consider submerged concrete strictly inaccessible in that it cannot be inspected. Submerged concrete is accessible for inspection via divers or during dewatering or low tide. The staff included wording in the AMP to acknowledge this. Additionally, the staff realizes that it may be difficult to inspect submerged concrete on the same frequency, and to the same level of accuracy, as exposed, above-grade concrete. To address this the staff included an option to justify longer inspection intervals for submerged concrete and noted that ACI 349.3R acceptance criteria and not required for concrete structures. When feasible submerged concrete should be inspected on the standard 5-year frequency; however, the staff understands that this may not always be reasonable or that plants may need to extend the interval, which is why wording was included that allowed for an extended interval with plant-specific justification in the SLRA.

Comment: 079

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Element 4, page XI.S7-3 to XI.S7-4:

New requirements for inspection of submerged concrete subject to aggressive groundwater or aggressive raw water for inspection on interval not to exceed 5 years is overly prescriptive and unnecessarily removes flexibility from the licensee. Other options such as inspection of an accessible leading indicator, invasive sampling and testing or an evaluation should be as determined by the responsible engineer based on the plant specific conditions. OE does not reflect the need for the new requirement to make inaccessible concrete accessible for inspection when exposed to aggressive groundwater or raw water.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The wording in Element 4 has been revised to allow more flexibility in the actions taken when concrete is exposed to aggressive groundwater.

The staff agreed that the recommendation may be overly prescriptive and burdensome. Licensees should be allowed the flexibility to decide the best method for managing their inaccessible concrete. However, the staff believes the evaluation and any associated actions should occur every 5 years.

Comment: 080

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Element 5, page XI.S7-4:

Revise the requirement for data recording to be less prescriptive and allow flexibility for site specific conditions and needs, measuring and recording all observed parameters regardless of size is not necessary, and does not add value. Limit recording and trending to significant findings for applicable parameters monitored or inspected. See comments on XI.S2 for this element.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. Element 5 was revised to clarify this expectation. Element 6 was also revised to indicate that indications that do not exceed the second-tier of ACI 349.3R are acceptable for concrete.

The staff's intention was for monitoring and trending to occur for all significant findings. Significance is described by appropriate acceptance criteria as outlined in Element 6.

Comment: 081

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Element 7, page XI.S7-4:

Eliminate the prescriptive requirements associated with assessing groundwater infiltration or through-concrete leakage for aging effects to allow for site specific assessment. We are not aware of any OE where groundwater in-leakage has resulted in age related degradation that has resulted in a loss of intended function. Monitoring through-wall leakage of groundwater for volume and chemistry is not feasible in cases of slight seepage, or for cases of leakage from multiple sources either closely or widely spaced, or in cases of intermittent leakage. Under existing programs, any through-wall leakage or groundwater infiltration that is identified is evaluated to determine appropriate further actions. Existing programs include evaluation of leaching to determine if it has resulted in an increase in porosity and permeability sufficient to cause a structurally significant loss of strength. Potential effect of aggressive groundwater is also evaluated. Monitoring for volume and chemistry of leakage water is an option that may be included in these evaluations, if determined appropriate by engineering. However, at present there is no established information available for correlation or evaluation of any data obtained which could be used to assess the data and the concrete physical condition. Recommending and effectively requiring utilities to gather and evaluate such data results in regulatory uncertainty.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The discussion in Element 4 regarding corrective actions was replaced with wording recommending an assessment of possible aging effects caused by groundwater in-leakage. Additionally, the word "may" was added to the guidance in Element 4 related to what information should be included in the assessment.

Requiring monitoring of volume and chemistry is not overly prescriptive. There is significant operating experience from recent license renewal application reviews with licensees finding through-wall leakage acceptable as-is with little or no evaluation. The staff does not consider through-wall leakage acceptable and expects some form of assessment to be completed when leakage is identified. Furthermore, the staff did not agree that monitoring the leakage is not feasible and that monitoring does not provide useful data. Significant changes in the volume or chemistry data of the leakage could be a leading indicator of concrete or reinforcing steel degradation. The guidance allows licensees to determine the appropriate parameters monitored along with the frequency of the monitoring and to determine what additional actions need to be taken based on the results of monitoring.

Source 019

Comment: 082

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Elements 1 and 3, Pages XI.S7-1 and 2:

Element 1–Coatings should not be included in the scope of the XI.S7 Program. Coatings typically are not relied upon to prevent corrosion or protect concrete and as such coatings have typically not been in the scope of license renewal for XI.S7 structures.

Element 3–Specific coatings inspection parameters should be removed since it is the underlying material that is in scope and subject to evaluation.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. To clarify that coatings themselves are not within the scope of this program, unless they have an intended function, wording was added to Element 1. The wording in Element 3 was revised to make it clear the coating is only inspected for signs of distress in the underlying material.

The staff agreed that coatings are generally not within the scope of license renewal and do not serve an intended function. However, many structures within the scope of license renewal are coated and still require a visual inspection. The intent of the proposed wording was to make it clear that coated structures within the scope of license renewal require a visual inspection regardless of whether or not the coatings are within scope.

Comment: 083

XI.S7 Inspection of Water-Control Structures Associated With Nuclear Power Plants

Description of Change and Justification (Basis):

Element 5 - Plants that have performed baseline or subsequent evaluations using quantitative acceptance criteria should not have to perform new baseline evaluations. Similarly early plants that may not have implemented quantitative acceptance or evaluation criteria for all parameters could add a program enhancement to add any necessary criteria and implement subsequent inspections to the new criteria during the subsequent period of extended operation.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. Element 5 was revised to clarify that existing inspection data can be credited for establishing the baseline. The staff agreed that existing inspection data can be credited for this baseline if the inspections were conducted with appropriate SLR acceptance criteria.

Comment: 084

SLR-GALL Table XI-01. FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management of Applicable Systems for SLR

Location of Change: XI.S1-IWE program (from pages X1 01-44 & 45)

Description of Change:

1. Leak rate testing should be deleted.

2. References to liner bulges should be deleted.

3. The additional supplemental surface examinations need more detail.

4. Generic requirements for volumetric examinations of areas only accessible from one side should be deleted.

5. The statement about surface examination of structural bolting should be deleted.

Justification For Change

1. The Appendix J program addresses leak rate testing. The IWE mentions leak rate testing where visual or surface examinations may not be adequate but does not contain the same level of detail as the Appendix J program.

2. See other comments for more detailed justification. In general, liner bulges are a normal result of a liner plate and there is no OE to indicate that liner bulges are an indication of corrosion.

3. It appears that some words were missing.

4. See other comments for more detailed justification. In general, this is beyond the Code, there is no relevant OE to justify this additional work.

5. This appears to be in error, as volumetric examination has been recommended to detect cracking where applicable of structural bolting, surface examination (PT or MT) is impractical for threaded areas and would require removal of bolts, also too much detail for AMP summary.

RESPONSE:

The NRC staff agreed with the comment in part, consistent with the response to Comments 019-043 thru 019-045 and the conforming revisions made to GALL-SLR Report AMP XI.S1, “ASME Section XI, Subsection IWE.” The FSAR Supplement Summary for AMP XI.S1 in GALL-SLR Table XI-01 were revised accordingly.

The staff revised the “Description of Program” column for AMP XI.S1 as marked up below:

The FSAR Supplement Summary for AMP XI.S1 in GALL-SLR Table XI-01 was revised to read as follows:

> This program is in accordance with ASME Section XI, Subsection IWE, consistent with 10 CFR 50.55a “Codes and standards,” with supplemental recommendations. The AMP includes periodic visual, surface, and volumetric examinations, ~~and leak rate testing,~~ where applicable, of metallic pressure-retaining components of steel containments and concrete containments for signs of degradation, damage, irregularities including liner plate bulges, and for coated areas distress of the underlying metal shell or liner, and corrective actions. 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~~. In addition, the program includes supplemental surface ~~or enhanced~~ examination~~s~~ to detect cracking for specific pressure-retaining components [identify components] subject to cyclic loading but have no CLB fatigue analysis; and if triggered by plant-specific operating experience, a one-time supplemental volumetric examination~~s~~ by sampling randomly-selected as well as focused 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.

Changes to the FSAR Supplement Summary for AMP XI.S1 were made consistent with the response to related public Comments 019-043 thru 019-045 and the conforming revisions made to AMP XI.S1.

Comment: 085

SLR-GALL Table XI-01. FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management of Applicable Systems for SLR

Location of Change:

XI.S2- IWL program (from pages X1 01-45)

Description of Change:

1. Note that ACI 349.3R Chapter 5 is a criteria to determine the level of evaluation required for examination results.

Justification For Change

1. See other comments for more detailed justification. In general, ACI 349.3R Chapter 5 is an evaluation criteria

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. Element 5 was revised to clarify this expectation. Element 6 was also revised to indicate that indications that do not exceed the second-tier of ACI 349.3R are acceptable for concrete.

The staff's intention was for monitoring and trending to occur for all significant findings. Significance is described by appropriate acceptance criteria outlined in Element 6.

Comment: 086

SLR-GALL Table XI-01. FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management of Applicable Systems for SLR

Location of Change

XI.S3-IWF program (from pages X1 01-45 & 46)

Description of Change

1. Delete the addition of 5% more supports to the scope of the program.

2. Add a clarification that volumetric examination of A325 and A490 bolts for cracking is not required.

Justification For Change

1. See other comments for more detailed justification. In general, this is beyond the scope of the ASME Code, Section XI and 10 CFR 50.55a, and there is no relevant OE to justify this additional requirement.

2. See other comments for more detailed justification. In general, these bolt materials are carbon steel bolting materials not susceptible to SCC.

RESPONSE:

1. The staff disagreed with this comment. However, the GALL-SLR Report was revised for clarity.

The staff clarified that the inspection of additional 5 percent of supports is a one-time inspection conducted within 5 years prior to entering the subsequent period of extended operation. The population of supports that are currently inspected in accordance with 10 CFR 50.55a include the same supports each inspection interval. This nominal increase allows that supports that have never been inspected can be verified to be representative of the entire population of supports, or could identify aging that is occurring in supports that have never been inspected during the life of the plant. Although other programs, walkdowns, or inspections could potentially identify age-related degradation of IWF supports, they may not, or issues may not be assigned appropriately to the IWF AMP. Operating experience should be an important consideration in determining the need for additional activities for the 60–80 year period; however, the sample chosen at the time the IWE Code was implemented in accordance with 10 CFR 50.55a, the sample selection required by ASME did not necessarily consider different aging mechanisms and effects necessary to be covered by aging management under 10 CFR Part 54. Addition of a select number of random inspections and inclusive of aging effects or environment most susceptible to degradation allows for better assurance that the IWF aging management program sample will be representative of the aging of the entire component support population during the subsequent period of extended operation.

2. The staff disagreed with this comment. The GALL-SLR Report has not been changed.

The staff's basis for adding/not deleting wording with respect to the FSAR Supplement is tied to the basis for agreeing or disagreeing with the associated comments, SCC is an applicable aging effect for high-strength bolting (actual measured yield strength greater than or equal to 150 ksi or 1034 MPa) in sizes greater than 1 inch nominal diameter in ASME Code applications, and therefore retained in GALL-SLR Report AMP XI.S3, "ASME Section XI, Subsection IWF." There is relevant operating experience in EPRI NP-5769, Volume 1 ("Degradation and Failure of Bolting in Nuclear Power Plants") of brittle failure of NSSS support bolting due to SCC, and the staff position is that for aging management, high-strength bolts with the properties described above that are included in ASME IWF applications, volumetric examinations should be performed for a sample of the bolts to determine whether cracking due to SCC has occurred. Note, this is not a change from the previous recommendation, it is a clarification that bolts meeting the criteria are subject to volumetric examination. The staff removed specific mention of ASTM A325 bolts because it is not likely that ASTM A325 bolting meeting the criteria is used. Also note that volumetric examinations may be waived with adequate plant-specific justification. This plant-specific justification would need to consider the population of high-strength bolts in IWF supports and determine on a component basis whether SCC is a credible aging effect. An example could include a detailed evaluation of SCC susceptibility with verification of a non-corrosive environment, and/or a one-time volumetric examination to confirm SCC is not occurring. A490 bolts are not considered exempt from volumetric examination on a material basis alone.

Comment: 087

SLR-GALL Table XI-01. FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management of Applicable Systems for SLR

Location of Change

XI.S6-Structures Monitoring (from pages X1 01-46 & 47)

Description of Change

1. Delete the reference to coatings.
2. Delete excessive detail with respect to recording results.

Justification For Change

1. This comment is addressed in more detail under other comments for the AMP. In general, the condition provides little useful information regarding the underlying coating, except potentially for coating blisters due to corrosion of carbon steel.

2. This comment is addressed in more detail under other comments for the AMP. In general, the requirement is too broad to apply quantitative measurements and trending to all applicable parameters monitored or inspected since not all parameters lend themselves to quantitative measurements and not all parameters can be usefully trended.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The wording related to coatings was deleted. As discussed in the response to Comment 019-066, coatings are generally only included in the program as an indicator of the condition of underlying materials. Therefore, it is unnecessary to include a discussion of coatings in the FSAR Supplement.

The staff did not agree that "for significant findings" needs to be added to the FSAR Supplement. Acceptance criteria should be properly set so that "significant findings" are identified. This issue is discussed further in response to Comments 019-070 and 019-073. No change was made as a result of this portion of the comment.

Comment: 088

SLR-GALL Table XI-01. FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management of Applicable Systems for SLR

Location of Change

XI.S7-Inspection of Water-Control Structures Associated with Nuclear Power Plants (from page X1 01-47)

Description of Change

Delete the phrase "for all applicable parameters monitored or inspected".

Justification For Change

This comment is addressed in more detail under other comments for the AMP. In general, the requirement is too broad to apply to quantitative measurements to all applicable parameters monitored or inspected since not all parameters lend themselves to quantitative measurements and not all parameters can be usefully trended.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The FSAR Supplement in the GALL-SLR Report has been edited to clarify that not all parameters lend themselves to quantitative measurements or trending. The staff understands that not all parameters lend themselves to quantitative measurements or trending. To acknowledge this, "applicable" was included in the original wording. To clarify this further, "all" was deleted in the final document. However, quantitative measurements exceeding the acceptance criteria should be recorded and trended for all parameters that lend themselves to quantitative measurements.

Source 019

Comment: **089**

SLR-GALL Table XI-01. FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management of Applicable Systems for SLR

Location of Change

XI.S8-Protective Coating Monitoring and Maintenance (from pages X1 01-47 & 48)

Description of Change

Delete information referring to design purposes of Service Level 1 protective coatings.

Justification for Change

The design purposes of coatings with respect to potential corrosion protection or decontamination are not relevant for this aging management program, which is intended to post-accident operability of ECCS. The UFSAR would be the appropriate place to address the design purposes of the coatings. This section is intended to describe aging management programs, not the design purposes of coatings.

RESPONSE:

The staff did not agree with this comment. The GALL-SLR Report has not been changed. The staff agreed that not all of the design functions of containment coatings are within the scope of license renewal aging management. However, staff believes it is prudent to mention them, for completeness, in the program description.

In addition, the GALL Report Revision 2 only referred to "*RG 1.54 Rev 1, or latest revision*," without providing this level of detail. The staff chose to paraphrase the regulatory guide instead of referring to the revision level in the GALL-SLR Report.

Comment: **090**

SLR-GALL Table XI-01. FSAR Supplement Summaries for GALL-SLR Report Chapter XI Aging Management of Applicable Systems for SLR

Location of Change

X.S1-Concrete Containment Tendon Prestress (from page X01-3)

Description of Change

Allow for corrective actions to maintain the minimum required prestressing force.

Justification For Change

Containment tendon prestress force monitoring programs allow and require corrective actions to maintain the minimum required prestress force, as required. The programs are not limited to only analytical justification of the trend line.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. The FSAR Supplement wording was replaced with the following:

> The program monitors and assesses the adequacy of the prestressing force for each tendon group based on type (i.e., hoop, vertical, dome, inverted-U, helical) and other considerations (e.g., geometric dimensions, whether affected by repair/replacement, etc.). The program ensures, during each inspection, that the trend lines of the measured prestressing forces remain above the minimum required value before the next scheduled inspections. Otherwise, corrective actions are taken to ensure containment prestress adequacy. Acceptance criteria follow 10 CFR 50.55a, ASME Section XI (Subsection IWL) and include construction of trend lines consistent with U.S. Nuclear Regulatory Commission (NRC) Information Notice (IN) 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete containments." The NRC Regulatory Guide (RG) 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," provides guidance for calculating prestressing losses and predicted forces. The program incorporates plant-specific and industry operating experience.

Source 020: NEI Attachment 7—Electrical Comments

Comment: 001 ***

Description of Change and Justification

XI.E1–1 Program Description:

Condition monitoring using non-visual testing methods on a sample population of cables that were found in adverse local environments (ALE) during the 1st and 2nd PEO. Recommend specifying an acceptable sample size as modeled in the Electrical Connections AMP (E6)–20% up to 25 cables.

Same for the Table 3.0-1 and Table XI-01 discussions in the SRP.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report.

The inspection of accessible cable and connection insulation material is used to evaluate the adequacy of inaccessible cable and connection electrical insulation. Accessible electrical cables and connections subjected to an adverse localized environment found in the performance of this aging management program (AMP) are visually inspected at least once every 10 years. This is an adequate period to preclude failures of the cables and connection electrical insulation since experience has shown that aging degradation is a slow process. A sample of 20 percent of each cable and connection type with a maximum sample size of 25 is tested. The following factors are considered in the development of the cable and connection insulation test sample: environment including identified adverse localized environments (high temperature, high humidity, vibration, etc.), voltage level, circuit loading, connection type, location (high temperature, high humidity, vibration, etc.), and insulation material.

Comment: 002

Description of Change and Justification

XI.E1-2 Element 3: Parameters Monitored or Inspected

There is no mention of the AMP's "testing portion" parameters is made in this element. Consider taking credit for existing surveillance/tests on those cables (as modeled in the E2 and E6 AMPs).

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. Element 4, Detection of Aging Effects, of AMP XI.E1, "Electrical Insulation for Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements," states that "Testing as part of an existing maintenance, calibration or surveillance program may be credited in lieu of testing recommended in this AMP."

Source 020

<u>Comment</u>: <u>003</u>

Description of Change and Justification

XI.E1-3 Element 6: Acceptance Criteria

The use of the word “free” is an unachievable acceptance criteria

There will always be some level of indication of aging effects on the cable or connection insulation surface.

Recommend:

Visual inspection results show that accessible cable and connection insulation material are free from <u>unacceptable</u> visual indications of surface abnormalities that indicate cable or connection insulation aging effects exist.

On a positive note, the SLR GALL XI.E1 Report Element 6 definition is very well written:

“An unacceptable indication is defined as a noted condition or situation, if left unmanaged, could potentially lead to a loss of the intended function.”

Consider its use in the other electrical AMPs.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. Element 6 now states that “accessible cable and connection insulation material are free from unacceptable signs of surface abnormalities that indicate unusual cable or connection insulation aging effects exist. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could potentially lead to a loss of the intended function.”

<u>Comment</u>: <u>004</u>

Description of Change and Justification

XI.E1–4 SRP Section 3.6

Table 3.0-1 and Table XI-01 implementation Schedule states “First inspection for license renewal….”

Does the definition of “inspection” now include the testing portion?

Visual inspection + Cable Tests = Inspection

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report to clarify the implementation schedule. The first inspection wording has been removed and replaced with more of a description of what needs to be completed 6 months before the subsequent period of extended operation. Visual inspection and cable testing are separate cable verification methods.

<u>Comment</u>: <u>005</u>

Description of Change and Justification

XI.E1 Markup

Page XI.E1-3 Markup

Program Description

(cables, connection electrical insulation) might be induced during accident conditions." Since the cable and connection electrical insulation is not subject to the **EQ** ~~*EA*~~ requirements of 10 CFR 50.49, an AMP is needed to manage the aging mechanisms and effects for the

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report to correct the typographical (editorial) error.

<u>Comment</u>: <u>006</u>

Description of Change and Justification

XI.E2–1 Program Description:

Having the same ALE discussion in two places results in confusion in later revisions; the definition of an ALE for E2 cables should be the same as E1 cables.

Example:

E1–Line 16, 17–An adverse localized environment is an environment that exceeds the most limiting environment (e.g., temperature, radiation, or moisture) for the electrical insulation of cable and connectors.

E2–Line 19, 20, 21–An adverse localized environment is an environment that exceeds based on the most limiting environment (e.g., temperature, radiation, or moisture) for the insulation of cable and connections or insulation material.

Recommend referring the ALE discussion to the E1 program discussion.

XI. E2-1 line 19, "…and environment that exceeds…" exceeds what?

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. The adverse localized environment program description is located under the GALL-SLR Report AMP XI.E1, "Electrical Insulation for Electrical Cables and Connections not subject to 10 CFR 50.49 Environmental Qualification Requirements," program description and the GALL-SLR Report AMP XI.E2, "Electrical Insulation for Electrical Cables and Connections not subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," program refers to the XI.E1 program for a discussion on adverse localized environment.

Source 020

<u>Comment</u>: <u>007</u>

Description of Change and Justification

XI.E3A–1 Program Description:

The focus of these AMPs is to manage cable insulation deterioration due to significant moisture. The discussion of the general definition of an ALE in AMPs E3A, E3B and E3C is out of place and confusing. Recommend removing the ALE discussion from E3 and just point the E1 program discussion if necessary.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. A discussion of adverse localized environments and methods of identifying them can be found in GALL-SLR Report AMP XI.E1, "Electrical Insulation for Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

<u>Comment</u>: <u>008</u>

Description of Change and Justification

XI.E3A–2 Element 2: Preventive Actions

Event driven inspections–Clarify "...thawing of ice and snow..." to "...<u>rapid</u> thawing of ice and snow..." (page XI.E3A-3, XI.E3B-4, XI.E3C-4)

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. In the Preventive Actions program element of XI.E3A-C, the adverb "rapid" was added to clarify that the event-driving occurrences that need inspections was atypical thawing that could result in the cables being submerged in water.

<u>Comment</u>: <u>009</u>

Description of Change and Justification

XI.E3B–1 Program Description:

Little known significant operating experience that warrants performing preventive actions or condition monitoring activities on submerged I&C cables.

Recommend a plant specific AMP for susceptible insulation materials or local operating experience.

Recommend using:

- One-time assessment prior to SPEO
- Specify an acceptable sample size modeled on the Electrical Connections AMP (E6)–20% up to 25 cables (aids in the staff's review efficiency)

- Credit existing surveillance activities for cable conditioning (modeled on the E6 AMP)

Based on the information gathered, further activities can be determined.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. The findings of the initial one-time test are evaluated to determine whether periodic testing of the cable connections are warranted. This finding forms the basis of site-specific operating experience for age-related degradation and informs the need for subsequent testing on a 10-year periodic basis. The justification and technical basis for not performing subsequent periodic testing is documented. This includes a discussion of the types of unacceptable conditions or degradation identified and whether they were determined to be age-related, requiring periodic maintenance. Electrical cable connections exposed to appreciable ohmic or ambient heating during operation may experience increased resistance of connection caused by repeated cycling of connected loads or by the ambient temperature environment. Different materials used in various cable system components can produce situations where stresses between these components change with repeated thermal cycling. For the cable testing portion of the AMP that utilizes sampling a 20 percent with a maximum sample of 25 constitutes a representative cable sample size, and this methodology is documented, as stated in the Detection of Aging Effects element. In addition, the same element states that credit can be used for certain existing programs.

Comment: 010

Description of Change and Justification

XI.E3C–1 Program Description

Little known significant operating experience that warrants performing preventive actions or condition monitoring activities on submerged low voltage power cables.

Recommend a plant specific AMP for susceptible insulation materials or local operating experience.

Table 3.0-1 and Table XI-01 mentions sample method; the GALL AMP report does not discuss using sample method when large numbers of low voltage power cables are in the scope of the program.

Recommend using:

- One-time assessment prior to SPEO

- Specify an acceptable sample size modeled on the Electrical Connections AMP (E6)–20% up to 25 cables (aids in the staff's review efficiency)

- Credit existing surveillance activities for cable conditioning (modeled on the E6 AMP)

Based on the information gathered, further activities can be determined.

Source 020

RESPONSE:

The staff agreed with the comment and associated changes were made to the GALL-SLR Report.

The findings of the initial one-time test are evaluated to determine whether periodic testing of the cable connections are warranted. This finding forms the basis of site-specific operating experience for age-related degradation and informs the need for subsequent testing on a 10-year periodic basis. The justification and technical basis for not performing subsequent periodic testing is documented. This includes a discussion of the types of unacceptable conditions or degradation identified and whether they were determined to be age-related, requiring periodic maintenance. Electrical cable connections exposed to appreciable ohmic or ambient heating during operation may experience increased resistance of connection caused by repeated cycling of connected loads or by the ambient temperature environment. Different materials used in various cable system components can produce situations where stresses between these components change with repeated thermal cycling.

For the cable testing portion of the AMP that utilizes sampling a 20 percent with a maximum sample of 25 constitutes a representative cable sample size, and this methodology is documented, as stated in the Detection of Aging Effects program element. In addition, the same program element states that credit can be used for certain existing programs.

Comment: 011

Description of Change and Justification

XI.E4–1 Program Description:

Bolted Connection Inspections should remain on a sample basis–the MEB AMPs have been effective using a sample method.

The cable bus duct discussion seems out of place since the AMR line items point to a plant-specific program. Recommend relocating the cable bus discussion to the SRP Section 3.6.2.2.2. The SLR GALL E4 Program Description can point to the SRP.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. A sample of accessible bolted connections is inspected for increased resistance of connection by using thermography or by measuring connection resistance using a micro ohmmeter. Twenty percent of the population with a maximum sample size of 25 constitutes a representative sample size. The cable bus discussion was removed from this AMP and reference was made to SRP-SLR Section 3.6.2.2.2 for site-specific further evaluation.

Comment: 012

Description of Change and Justification

XI.E4–2 Element 4: Detection of Aging Effects (Page XI.E4-3)

Thermography should be considered a condition monitoring test, not a visual inspection method.

Recommend the following change (Page XI.E4-3):

26 The first inspection for measuring connection resistance or thermography is completed prior to the 27 subsequent period of extended operation and every 10 years thereafter. This is an 30 As an alternative to thermography or measuring connection resistance of bolted connections, for 31 accessible bolted connections covered with heat shrink tape, sleeving, insulating boots,

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. Editorial changes were made to provide clarification and consistency.

Comment: 013

Description of Change and Justification

XI.E4–3 Element 7: Corrective Actions

Corrective actions are prescriptive as written.

Recommend the following change (Page XI.E4-4):

22 Corrective actions are taken and an engineering evaluation is performed when the 23 acceptance criteria are not met. Corrective actions may include, but are not limited, to

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. Editorial changes were made to provide clarification and consistency.

Comment: 014

Description of Change and Justification

XI.E5–1 Program Description:

Strengthen the alignment with the XI.E1 AMP Report.

Recommend an explicit statement:

Insulation portion of fuse blocks in the E5 AMP scope is evaluated in E5 AMP.

Insulation portion of fuse blocks not in E5 AMP scope is evaluated in the E1 AMP.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. Clarified in the discussion of AMP XI.E1, “Electrical Insulation for Electrical Cables and Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” and AMP XI.E5, “Fuse Holders,” what portion of the insulation is in the scope of AMP XI.E5.

Source 020

<u>Comment</u>: **<u>015</u>**

Description of Change and Justification

XI.E5–2 Element 7: Corrective Actions

The discussion should be edited to tailor it to the scope of this program; the generic discussion does not apply (i.e., recalibration and circuit troubleshooting).

Recommend using the element 7 discussion in XI.E7 has a more suitable model for the E5 AMP.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. The second paragraph of the Corrective Actions program element of AMP XI.E7, "High-Voltage Insulators," concerning recalibration and circuit troubleshooting, was removed to provide clarification and consistency.

<u>Comment</u>: **<u>016</u>**

Description of Change and Justification

XI.E6–1 Program Description:

Little known significant operating experience that warrants performing periodic condition monitoring activities on electrical cable connections.

Recommend a plant specific AMP for local operating experience.

Recommend using:

- One-time assessment prior to SPEO

Based on the information gathered, further periodic activities can be determined.

RESPONSE:

The staff partially agreed with the comment and associated changes have been made to the GALL-SLR Report.

The findings of the initial one-time test are evaluated to determine whether periodic testing of the cable connections are warranted. This finding forms the basis of site-specific operating experience for age-related degradation and informs the need for subsequent testing on a 10-year periodic basis. The justification and technical basis for not performing subsequent periodic testing is documented. This includes a discussion of the types of unacceptable conditions or degradation identified and whether they were determined to be age-related, requiring periodic maintenance. Electrical cable connections exposed to appreciable ohmic or ambient heating during operation may experience increased resistance of connection caused by repeated cycling of connected loads or by the ambient temperature environment. Different materials used in various cable system components can produce situations where stresses between these components change with repeated thermal cycling.

<u>Comment</u>: <u>017</u>

Description of Change and Justification

XI.E7–1 General Comment

Two aging effects of concern should be so delineated throughout GALL program discussion.

This new program is to manage contamination of HVI from environmental conditions and loss of material of the external surfaces of metallic components of HVI due to mechanical wear or corrosion.

The program description and elements 1 through 6, at a minimum need to address both of these potential aging effects or state that it is not applicable.

For example, element 2 should state that there are no program preventative actions for loss of material of metallic components.

As another example, in element 3 the frequency of inspection is 5 years instead of twice per year for insulators that are coated. Not aware of information that supports coating of insulator surfaces would prevent loss of material of metallic components.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. The high voltage insulator program was developed specifically to age manage high voltage insulators susceptible to aging degradation due to local environmental conditions in order to provide reasonable assurance that the intended functions of high voltage insulators within the scope of subsequent license renewal are maintained consistent with the current licensing basis through the subsequent period of extended operation. The metallic components associated loss of material and aging degradation are covered under this program, and its elements, as is high-voltage insulators environmental conditions. Element 3 states that visual inspections are at a frequency based on plant-specific operating experience (OE) and does not state a specific time.

<u>Comment</u>: <u>018</u>

Description of Change and Justification

XI.E7–2 Program description

“Adverse localized environment” discussion is not appropriate here in context of how it is defined in the other AMPs.

Some switchyards include intermediate medium voltage distribution systems that utilize post insulators–recommend refining the HVI commodity definition.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. Text edited to clarify and describe high voltage insulator environments. The high-voltage insulator program was developed specifically to manage aging of high-voltage insulators susceptible to aging degradation due to local environmental conditions. Reference to an adverse localized environment was removed because it applies to indoor environments.

Comment: 019

Description of Change and Justification

XI.E7–3 Element 1

High voltage insulators (HVI) could be in scope for SLR for many reasons, not just those credited for recovery of offsite power.

Recommend clarifying the phrase–"within the scope of the subsequent period of extended operation."

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. Element 1 text edited to clarify and remove the reference to recovery of offsite power.

Comment: 020

Description of Change and Justification

XI.E7–4 Element 2

Inspections do not prevent the build of HVI contamination.

Use of a corona camera is more appropriate, rather than thermography for this AMPs.

RESPONSE:

The staff partially agreed with the comment and associated changes have been made to the GALL-SLR Report in order to provide reasonable assurance that the intended functions of high voltage insulators within the scope of SLR are maintained consistent with the current licensing basis through the subsequent period of extended operation. The high voltage insulator program was developed specifically to manage aging of high voltage insulators susceptible to aging degradation due to local environmental conditions. In the staff's opinion, the corona camera is not a replacement for thermography in this AMP.

Comment: 021

Description of Change and Justification

XI.E7–5 Element 3

Twice per year inspection is too prescriptive.

Recommend the inspection frequency should be based on plant operating experience (use the E3 cable vault inspection frequency model).

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report in order to provide clarification to the AMP and make it less prescriptive and more plant-specific depending on operating experience.

Comment: **022**

Description of Change and Justification

XI.E7–6 Element 6

Use of the word “free” is an unachievable acceptance criteria.

There will always be some level of contamination on the high-voltage insulator surface. There will be some small amount of acceptable material loss on the metallic parts of the HVI.

Consider the following change:

Acceptance Criteria: High voltage insulator surfaces are free of unacceptable contamination such as significant salt or dust buildup or other contaminants. Metallic parts must be free of unacceptable loss of materials due to pitting, crevice, and general corrosion. Acceptance criteria will be

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report with clarification made to this AMP to include the wording “free of unacceptable contamination.”

Comment: 023

Description of Change and Justification

X.E1–1 Underlying Assumptions (Page X.E1-4).

Statement is made that the first periodic inspection is to be performed prior to the subsequent period of license renewal. This, if implemented, creates additional requirements for the EQ Program and EQ equipment prior to SLR.

Clarify that the SLR AMP X.E1 Report is limited to passive components only.

The intent of X.E1 is to manage cable and connection insulation material. Recommend defining EQ electrical equipment in the GALL Report to mean cable and connection insulation material (See SLR SRP Section 2.5.3).

Avoids conflicts with Regulatory Guide 1.89 and 10CFR50.49 attributes for active equipment.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report in order to clarify that the GALL-SLR Report AMP X.E1, “Environmental Qualification of

Electric Equipment,” is limited to passive components only, and avoid conflicts with 10 CFR 50.49 attributes for active equipment.

Comment: 024

Description of Change and Justification

X.E1–2 References (Page X.E1-8):

Delete “2015” after 10 CFR references.

Providing the year date of 2015 is irrelevant related to the Code of Federal Regulations.

RESPONSE:

The staff disagreed with this comment. The GALL-SLR report has not been changed in response to this comment. The date identifies the year of publication.

Comment: 025

Description of Change and Justification

X.E1–3 References (Pages X.E1-8 and X.E1-9):

Delete international cable related references.

International Cable-related references are not applicable to the US-related SLR activities (Vienna, IAEA, Japan, France).

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report. International references contain some relevant information on cables; however, their inclusion is not appropriate because they have not been officially approved by the NRC.

Comment: 026

Description of Change and Justification

X.E1-4 SRP Section 4.4.1.1.1

Statement was added on Line 35 & Line 36 (Section 4.4.1.1.2) regarding 10 CFR 50.49 (L) required to be addressed.

This is the Legacy upgrade requirement of 10 CFR 50.49 unless “Sound Reasons To The Contrary” exists and is documented.

This applies to NUREG–0588 CAT II equipment in this section, but this same statement was not added to SRP Section 4.4.1.1.1 for DOR equipment, which also applies.

RESPONSE:

The staff agreed with the comment and associated changes have been made to the GALL-SLR Report AMP in order to provide clarification and make it consistent with the other GALL-SLR Report electrical AMPs.

Comment: 027

X.E1–ENVIRONMENTAL QUALIFICATION OF ELECTRIC COMPONENTS–Markups

This comment consisted of 3 pages of markups to the draft GALL-SLR Report which inserted the word “passive” in a number of places in AMP X.E1. These were all reviewed and the response is provided below.

RESPONSE:

The staff partially agreed with the comment and associated changes have been made to the GALL-SLR Report in order to clarify that the GALL-SLR Report AMP X.E1 is limited to passive components only, and avoid potential conflicts with Regulatory Guide 1.89 and 10 CFR 50.49 attributes for active equipment.

Source 021: Andrew Prinaris—Structural Comments

Comment: 001

In XI.S1, S3, S6, and S7, replace referenced "Specification for Structural Joints Using High Strength Bolts," 2009 edition of the Research Council on Structural Connections (RCSC), with "Specification for Structural Joints Using High Strength Bolts," 2014 edition (with April 2015 Errata). The technical basis for the proposed change is related to coating of bolts. The new edition of the RCSC deletes coating ASTM F1136, "Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners," on ASTM F1852 from Table 2.1, because such coating has not been approved by ASTM for use on TC bolts. The same guidance is also discussed by RCSC in the preface of the 2014 edition of the specifications for ASTM F2280 bolts.

RESPONSE:

The staff agreed with this comment and associated changes to the aforementioned aging management programs (AMPs) in the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report have been made. The references have been changed to note August 2014. The Research Council on Structural Connections (RCSC) reference listed in the References section of GALL-SLR AMPs XI.S1, "ASME Section XI, Subsection IWE," XI.S3, "ASME Section XI, Subsection IWF," XI.S6, "Structures Monitoring," and XI.S7, Inspection of Water-Control Structures Associated With Nuclear Power Plants," is revised to state:

> Research Council on Structural Connections, "Specification for Structural Joints Using High Strength Bolts," August 2014.

The new edition of the RCSC deleted coating ASTM F1136 and ASTM F1852 from Table 2.1 because such coating has not been approved by ASTM for use on tension-controlled bolts. The AMPs listed in the comment reference to ASTM F1852 and F2280 bolts, and Section 2 of the RCSC specification for consideration of preventive actions for storage, lubricant selection, and bolting and coating material selection.

Comment: 002

In XI.S6 and S7, there is a lack of sampling regarding detection of aging effects for Non-ASME structural supports. It is proposed in Program Element 4 "Detection of Aging Effects," RG 1.199, "Anchoring Components and Structural Supports in Concrete," is referenced for evaluation and quality assurance guidance for anchorage of components and structural supports on concrete structures, based on sampling. Suggested verbiage shown below in italics is recommended for Program Element 4, "Detection of Aging Effects," to be inserted on page XI.S6-3 of DRAFT NUREG–2191, Volume 2, line 17:

includes provisions for more frequent inspections based on an evaluation of the observed degradation. *"Sampled evaluation of anchor bolts (e.g., tightness of anchor bolts, spalling and cracking around anchor bolts) and for gaps between equipment base and concrete surface should follow the guidance of RG 1.199, "Anchoring Components and Structural Supports in Concrete" and applicable industry standards. The representative sample should address specific anchorage (e.g. anchor bolt types) exposed to specific environments. Detection of aging effects to be extended to the rest of the sampled pipe supports."* The responsible

Source 021

Add reference:

Nuclear Regulatory Commission, Regulatory Guide 1.199, “Anchoring Components and Structural Supports in Concrete,” Washington, DC, U.S. Nuclear Regulatory Commission: 2003.

RESPONSE:

The staff did not agree with this comment. GALL-SLR Report AMPs XI.S6, “Structures Monitoring,” and AMP XI.S7, “Inspection of Water-Control Structures Associated With Nuclear Power Plants,” are not sampling programs. It is expected that licensees visually inspect 100 percent of the systems, structures, and components within the scope of the program. If a licensee is unable to meet this guidance, they can propose and justify a different approach.

<u>Source 025: EPRI—AMPs XI.M7, XI.M9, XI.M11B, XI.M16A, XI.M31, XI.E1, XI.E2, XI.E3A, XI.E3B, XI.E3C</u>

<u>Comment: 001</u>

XI.M7, BWR Stress Corrosion Cracking

Elements 3 and 4 of the draft AMP state that examination and inspection methods are delineated in EPRI technical report, BWRVIP-75-A *BWR Vessel and Internals Project, Technical Basis for Revision to Generic Letter 88-01 Inspection Schedules* (1012621I). BWRVIP-75-A does not include guidance relative to examination, inspection methods, or test techniques. It only provides alternative guidance for extent and schedule.

Reference to BWRVIP-75-A relative to examination methods or test techniques should be removed. Retain the references to NUREG–0313, Rev.2, and NRC GL 88-01.

RESPONSE:

The staff agreed with this comment. The references to Boiling Water Reactor Vessel and Internals Project (BWRVIP)-75-A were deleted as the comment recommended.

<u>Comment: 002</u>

XI.M9, BWR Vessel Internals

Screening of Cast Austenitic Stainless Steel (CASS) Reactor Internals Page XI.M9-1, rows 19 thru 44 (Program Scope) describes screening criteria applicable to CASS reactor internals and page XI.M9-3, row 28 includes a fluence threshold of 1E17 N/cm^2 for consideration of fracture toughness in CASS reactor internals.

There are ongoing activities related to NRC review of the BWRVIP approach for management of CASS internals. The BWRVIP recently received a draft Safety Evaluation (SE) from the NRC Division of Engineering based on their review of BWRVIP-234 *BWR Vessel Internals Project, Thermal Aging and Neutron Embrittlement Evaluation of Cast Austenitic Stainless Steel for BWR Internals* (1019060). The review of the draft SE may result in a change to the screening threshold and inspection scope which should be reflected in the final AMP recommendation.

An allowance for an alternative screening criteria is mentioned on page XI.M9.

RESPONSE:

See the response to Comment 016-038 that addresses a need to reference the staff's SE regarding BWRVIP-234. The program element is revised to refer to the SE.

<u>Comment: 003</u>

XI.M9, BWR Vessel Internals

An allowance for an alternative screening criteria is mentioned on page XI.M9. The text should be clarified to confirm that one acceptable alternative is the screening criteria associated with BWRVIP-234 and the associated NRC SE.

Source 025

RESPONSE:

See the response to Comment 016-038 that addresses a need to reference the staff's SE regarding BWRVIP-234. The program element is revised to refer to the SE.

Comment: 004

XI.M9, BWR Vessel Internals

For the SLR period, only the reinspection requirements of BWRVIP-183, *BWR Vessel and Internals Project, Top Guide Grid Beam Inspection and Flaw Evaluation Guidance* (1013401), will apply: to inspect 10 percent of grid cells every 12 years. The recommendation to inspect an additional *5* percent of grid cells within 12 years of entering the SLR period is not based on research or operating experience. Also note that inspections may be performed using either EVT-1 or UT (not just EVT-1 as stated in XI.M9). Additionally, for the Top Guide Grid Beams, the NRC recently issued a SE approving the BWRVIP approach described in BWRVIP-183. This should be reflected in the GALL-SLR.

RESPONSE:

The staff agreed with this comment and associated changes have been made as follows: The program includes inspection of 10 percent of the top guide locations using enhanced visual technique (EVT-1) or ultrasonic testing every 12 years with at least 5 percent inspected within the first 6 years of each 12-year interval.

Comment: 005

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)

NRC has proposed two new recommendations in Section 4-Detection of aging effects of this AMP:

1. Branch Connections: "The program also performs a baseline volumetric or inner-diameter surface inspection of all susceptible nickel alloy branch line connections and associated welds as identified in Table 4-1 of MRP-126 if such components or welds are of a sufficient size to create a loss of coolant accident (LOCA) through a complete failure (guillotine break) or ejection of the component. The baseline inspection is performed prior to the subsequent period of extended operation using a qualified method in accordance with Appendix IV or VIII of ASME Code Section XI as incorporated by reference in 10 CFR 50.55a, or equivalent. Existing periodic inspections using volumetric or surface examination methods may be credited for the baseline inspection. If the baseline inspection indicates the occurrence of PWSCC, periodic volumetric or inner-diameter surface inspections are performed with adequate periodicity."

MRP-126, *Materials Reliability Program Generic Guidance for Alloy 600 Management* (1009561), documents locations with dissimilar metal welds that could be susceptible to Stress Corrosion Cracking (SCC) in a PWR environment. MRP-139, *Primary System Piping Butt Welds Inspection and Evaluation Guidelines* (1015009), documents dissimilar metal weld locations where inspection is needed. MRP-139 became the basis for the ASME Code Case, N-770. Based on research and operating experience Code Case N-770 provides reasonable assurance of safety for inspection and evaluation of dissimilar metals welds susceptible to SCC.

RESPONSE:

The staff did not agree with this comment. The GALL-SLR Report has not been changed. See the staff's responses to Comment 016-051.

Comment: 006

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)

NRC has proposed two new recommendations in Section 4-Detection of aging effects of this AMP:

2. Bottom Mounted Nozzles (BMN): "In addition, this program performs a baseline inspection of bottom-mounted instrumentation (BMI) nozzles of reactor pressure vessels (RPVs) using a qualified volumetric examination method. The inspection is conducted on all susceptible nickel alloy BMI nozzles prior to the subsequent period of extended operation. If this inspection indicates the occurrence of PWSCC, periodic volumetric inspections are performed on these nozzles and adequate inspection periodicity is established. Alternatively, applicant-proposed and staff-approved mitigation methods may be used to manage the aging effect for these components."

The MRP's BMN safety assessment, shared with NRC in public meetings, concludes that a program of regular visual examinations provides reasonable assurance for detection of leakage.

RESPONSE:

The staff agreed with the comment. The staff also considered the discussions held during public meetings regarding subsequent license renewal guidance documents (e.g., April 26, June 1 and 23, and July 26, 2016). The baseline examination provision for bottom-mounted instrumentation (BMI) nozzles is deleted. See staff's response to Comment 016-048.

Comment: 007

XI.M16A PWR Vessel Internals

DELETED in GALL. To be replaced by plant-specific program.

Chapter XI.M Aging Management chapters; Consideration should be given to retaining the AMP XI.M16A regarding PWR Reactor Internals aging management. The existing MRP-227-A, *Materials Reliability Program*: *Pressurized Water Reactor Internals and Evaluation Guidelines* (1022863), for 40-60 years is a technically robust aging management program based on proactive inspections and activities to monitor aging mechanisms in the plants. The techniques and inspection strategies have been proven over many years both within the BWRVIP and PWR-MRP programs. Industry has an on-going initiative through EPRI to establish any supplemental requirements to MRP-227-A that may be needed to address the SLR application for 60-80 years life. This effort is expected to be completed in the 20 19-2020 time-frame.

RESPONSE:

The staff agreed with the comment. The baseline examination provision for BMI nozzles is deleted. See the response to Comment 016-048.

Comment: 008

XI.M31, Reactor Vessel Material Surveillance

Page XI.M31-1: "The 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."

GALL-SLR references E185 (as per Appendix H guidelines), Appendix H is being revised to recognize E2215 and E185.

RESPONSE:

The staff did not agree with this comment. Partially in response to this comment, the first sentence in the second paragraph in the program description of GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance", were revised. Also, see responses to similar Comment 018-003. Specifically, the staff amended the referenced AMP program description sentence to cite compliance with 10 CFR Part 50, Appendix H, rather than providing a reference to a specific ASTM standard. The sentence now reads:

"*The surveillance program must meet the requirements of 10 CFR Part 50, Appendix H.*"

The staff agreed that many reactor pressure vessel (RPV) surveillance programs were designed to program criteria in earlier editions of ASTM Standard Practice Designation E185, such as those in the 1973 or 1979 editions of the standard practice designation. The change to the referenced sentence is consistent with NRC regulations.

Comment: 009

XI.M31, Reactor Vessel Material Surveillance

Page XI.M31-1: "The 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."

GALL-SLR should be consistent and reference both ASTM standards.

RESPONSE:

See response above to Comment 025-008.

Comment: 010

XI.M31, Reactor Vessel Material Surveillance

Page XI.M3 1-1 Lines 21-24- States that if standby capsules are going to be included and are not in the vessel, they shall be reinserted. However, on page XI.M31-4 (lines 40-45) it states that if a capsule has already been pulled and has enough fluence it can be tested without inserting it back into the vessel.

These statements seem to conflict.

RESPONSE:

The staff agreed with this comment. The comment statements are identical to those provided in Comment 018-029. The staff made appropriate changes to the program description and Monitoring and Trending program element in GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance," to address these comments.

To correct any potential misinterpretations by prospective applicants and to resolve these comments, the staff amended the fourth sentence in the second paragraph of the program description in GALL-SLR Report AMP XI.M31 to indicate that the capsules "*should be reinserted, as necessary . . .*" The sentence now states:

> If standby capsule(s) will be incorporated into the Reactor Vessel Material Surveillance program for withdrawal and testing to address the subsequent period of extended operation and the capsule(s) has already been withdrawn from the reactor vessel and placed in storage, the surveillance capsule(s) should be reinserted, if necessary, in a location with an appropriate lead factor to ensure that the neutron fluence of the surveillance capsule and the test results will, at a minimum, bound the peak neutron fluence of interest projected to the end of the subsequent period of extended operation.

The staff also amended the second paragraph in the Monitoring and Trending program element for AMP XI.M31 to provide more detailed guidance for the staff expectations for supplemental (standby) capsule removal and test specimen testing expectations for the subsequent period of extended operation. The revised "Monitoring and Trending" paragraph now reads as follows:

> The plant-specific surveillance program or ISP has at least one capsule that has attained or will attain neutron fluence between one and two times the peak reactor vessel wall neutron fluence of interest at the end of the subsequent period of extended operation. If a capsule meeting this neutron fluence criterion has not been tested previously, then the program includes withdrawal and testing (or alternatively the retrieval from storage, reinsertion for additional neutron fluence accumulation, if necessary, and testing) of one capsule addressing the subsequent period of extended operation. (If a surveillance capsule was previously identified for withdrawal and testing to address the initial period of extended operation, it is not acceptable to redirect or postpone the withdrawal and testing of that capsule to achieve a higher neutron fluence that meets the neutron fluence criterion for the subsequent period of extended operation.) The program withdraws, and subsequently tests, the capsule(s) at an outage in which the capsule receives a neutron fluence of between one and one and two times the peak reactor vessel neutron fluence of interest at the end of the subsequent period of extended operation. Test results from this capsule are reported as described in 10 CFR Part 50, Appendix H. If an existing standby capsule that has been previously withdrawn from the reactor vessel is used for testing to meet the neutron fluence criterion for the subsequent period of extended operation and the capsule does not require additional irradiation, then that (formerly standby) capsule is incorporated into the surveillance capsule withdrawal schedule of the Reactor Vessel

> Material Surveillance program upon receipt of the subsequently renewed license, and reporting of the test results is consistent with 10 CFR Part 50, Appendix H, with the “withdrawal date” of the capsule considered to be no later than the date of the subsequently renewed license.

Comment: **011**

XI.M31, Reactor Vessel Material Surveillance

Page XI.M31-5, lines 32-37: “If the plant uses an embrittlement trend curve to determine embrittlement (such as those of RG 1.99, Rev. 2, 10 CFR 50.61, and 10 CFR 50.61a), the program ensures that the operating conditions for the reactor vessel beltline are within the applicability limits of the embrittlement trend curve with respect to parameters such as irradiation temperature, neutron fluence, and flux, or provides technical justification for exceeding these applicability limits.”

This provision modifies the requirements of 10 CFR 50.61. The guidance needs to be clarified to with regard to intent of the AMP wording.

RESPONSE:

The staff partially agreed with this comment. The comments are identical to those provided in Comment 018-030. The staff made appropriate changes to the program description and Monitoring and Trending and Parameters Monitored or Inspected program elements in GALL-SLR Report AMP XI.M31, “Reactor Vessel Material Surveillance,” to address these comments.

The staff did not agree with the comment statements that the staff was changing the requirements in the 10 CFR 50.61 regulation, but did agree that the related statements in the referenced sentence, and even in the last two paragraphs of the Monitoring and Trending program element for AMP XI.M31 were related to evaluations of related RPV neutron irradiation embrittlement TLAAs, as defined in SRP-SLR Section 4.2, and not to any programmatic monitoring criteria for implementing the AMP.

The staff deleted the last two paragraphs of the GALL-SLR Report AMP XI.M32, “One-Time Inspection,” of the Monitoring and Trending program element. In addition, the staff moved any needed cross-referenced statements relating AMP program element criteria to those for performing related RPV neutron irradiation embrittlement TLAA calculations into the Parameters Monitored or Inspected program element. The Parameters Monitored or Inspected program element has been modified to include the following statement:

> “The peak reactor vessel neutron fluence of interest at the end of the subsequent period of extended operation should address the TLAAs as described in the following sections of the SRP-SLR, as applicable: Sections 4.2.2.1.2 (Upper-Shelf Energy), 4.2.3.1.3 (Pressurized Thermal Shock) and 4.2.3.1.4 (Pressure-Temperature Limits) for PWRs; and Sections 4.2.2.1.2 (Upper-Shelf Energy), 4.2.3.1.4 (Pressure Temperature Limits), 4.2.3.1.5 (Elimination of Boiling Water Reactor Circumferential Weld Inspection) and 4.2.3.1.6 (Boiling Water Reactor Axial Welds) for BWRs.”

Comment: 012

XI.M31, Reactor Vessel Material Surveillance

Page XI.M31-3, lines 11-13: The proposed GALL for SLR states that "This program includes removal and testing of at least one capsule...with a neutron fluence of the capsule between one

This tightens of the target fluence band for the period of SLR. The latest ASTM Standard, E2215, was developed with extended operation being considered, and this standard retains a target of between one and two times end of life fluence.

Irradiation embrittlement is primarily a fluence driven effect. The latest version of ASTM E900 identifies an embrittlement trend curve that has no consideration of flux effects. As such, time effects for surveillance data are of very minor significance and we suggest retaining the prior fluence band.

RESPONSE:

This comment is analogous to Comments 018-007. The staff's basis for resolving these comments and the basis for the changes that the staff made to GALL-SLR Report AMP XI.M31, "Reactor Vessel Material Surveillance," are the same.

Comment: 013

Electrical Cables

XI.E1, Electrical Insulation for Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements

EPRI Guidance for cable aging management could be used as reference material and be relied upon as a resource for this section. Guidance is provided in the following three reports:

– For Medium Voltage, Plant Engineering: Aging Management Program Guidance for Medium-Voltage Cable Systems for Nuclear Power Plants, Revision 1. (3002000557).

For Low Voltage, Plant Support Engineering: Aging Management Program Development Guidance for AC and DC Low-Voltage Power Cable Systems for Nuclear Power Plants. (1020804).

For I&C, Plant Support Engineering: Aging Management Program Development Guidance for Instrument and Control Cable Systems for Nuclear Power Plants. (1021629).

These reports have been made available to the NRC staff for their review under our memorandum of understanding (MOU). In addition there have been a number of technical exchange meetings on cable aging management. As the NRC staff develops the final AMPs EPRI would like to work with the NRC staff to ensure a clear understanding of the technical content and references to EPRI reports for aging management.

Source 025

RESPONSE:

The staff did not agree with the comment. The GALL-SLR Report has not been changed in response to this comment. The NRC staff cannot add references that have not been reviewed and approved by NRC.

Comment: 014

Electrical Cables

XI.E2, Electrical Insulation for Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits

Identification of insulation deterioration by insulation resistance should be replaced with more general terminology such as "cable insulation deterioration shall be monitored by some combination of physio-chemical and mechanical or electrical testing determined by the licensee to be appropriate for the aging conditions identified". This AMP also identifies reduced electrical insulation resistance as the main way of evaluating cables that will more likely be detected by other physical, mechanical or electrical testing other than insulation resistance.

RESPONSE:

The staff agreed with the comment and recommended changes to the GALL-SLR Report have been made.

The AMP as written explains the intended function of the applicable aging effects. Exposure of electrical insulation to an adverse localized environment caused by temperature, radiation, or moisture can cause age degradation resulting in reduced electrical insulation resistance, moisture intrusion related connection failures, or errors induced by thermal transients. Reduced electrical insulation resistance causes an increase in leakage currents between conductors and from individual conductors to ground. A reduction in electrical insulation resistance is a concern for all circuits, but especially those with sensitive, high voltage, low-level current signals, such as radiation monitoring and nuclear instrumentation circuits, because a reduced insulation resistance may contribute to signal inaccuracies. In this AMP, either of two methods can be used to identify the existence of electrical insulation aging effects for cables and connections. In the first method, calibration results or findings of surveillance testing programs are evaluated to identify the existence of electrical cable and connection insulation aging degradation. In the second method, direct testing of the cable system is performed. In addition, clarification text was added to element 4 for effective testing determination.

Comment: 015

Electrical Cables

XI.E3A, Electrical Insulation for Inaccessible Medium Voltage Power Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements

Revise to allow licensee to describe their test methodology to detect degraded/wet cable insulation. This AMP under "Parameters of Aging" and "Detection of Aging" also identifies reduced electrical insulation resistance as the main way of evaluating cables.

RESPONSE:

The staff agreed with the comment and recommended changes have been made to the GALL-SLR Report. The inspection frequency for water accumulation is established and performed based on plant-specific operating experience with cable wetting or submergence. Cables in submerged environments for which they were not designed for an extended period of time need to be age managed (on a sampling basis) to gain reasonable assurance for performing the intended functions.

Comment: 016

Electrical Cables

XI.E3A, Electrical Insulation for Inaccessible Medium Voltage Power Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements

Insulation resistance is not the parameter of concern. Loss of dielectric strength (ac breakdown, high dielectric loss) is the major concern. EPRI's work on "Tan Delta" testing may be a valuable reference. *[Plant Engineering: Evaluation and Insights from Nuclear Power Plant Tan Delta Testing and Data Analysis-Update* (3002005321).]

RESPONSE:

The staff did not agree with the comment. The GALL-SLR Report has not been changed in response to this comment. The staff has not endorsed this document. As the AMP does not prescribe any particular test or condition monitoring method, the licensee may propose and justify the particular testing as applicable.

Comment: 017

Electrical Cables

XI.E3B, Electrical Insulation for Inaccessible Instrument and Control Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements

Make this conditional based on OE. Although there are instances of I&C cables failing in wet locations, no widespread, statistically significant, or research/forensic evidence that a common cause deterioration has been identified. A useful reference is: *Aging Management Program Development Guidance for Instrument and Control Cable Systems for Nuclear Power Plants.* (1021629).

RESPONSE:

The staff partially agreed with the comment and associated changes have been made to the GALL-SLR Report. Visual inspection results and plant-specific operating experience determines the particular course of action to address aging effects of instrumentation and control (I&C) cables in wet environments. The AMP allows for actions based on engineering evaluation of visual inspections and plant operating experience. The staff has not endorsed the report mentioned in the comment.

Source 025

<u>Comment</u>: **<u>018</u>**

Electrical Cables

XI.E3C, Electrical Insulation for Inaccessible Low Voltage Power Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements

This requirement could be conditional based on operating experience. Although there are instances of I&C cables failing in wet locations, there is no widespread, statistically significant, or research/forensic evidence that a common cause deterioration has been identified. A useful reference is: *Aging Management Program Development Guidance for AC and DC Low-Voltage Power Cable Systems for Nuclear Power Plants.* (1020804).

RESPONSE:

The staff agreed with the comment and associated changes to the GALL-SLR Report have been made. Visual inspection results and plant-specific operating experience determines the particular course of action to address aging effects of I&C cables in wet environments. The AMP allows for actions based on engineering evaluation of visual inspections and plant operating experience. The staff has not endorsed the report mentioned in the comment.

Source 030: Paul Frey—Diablo Canyon PowerPoint Presentation

Comment: 001

See attached file(s). Some components cannot be inspected, leading to the results on the attached Powerpoint.

Attachments

Diablo Powerpoint 6

(See attachment on Page 2 in reference titled, "Potential Economic Damages To California After Diablo Canyon Nuclear Power Plant Meltdown And Fuel Pool Fires Using Chernobyl Damages And Fallout Pattern As A Reference Base")

RESPONSE:

The attachment is a PowerPoint file and there are no comments attached to the PowerPoint. The topics covered in the PowerPoint file are the same as the title noted above.

The commenter's concerns regarding the potential local and state dangers presented by an accident at the Diablo Canyon Nuclear Generating Station would be addressed as part of the individual plant's license renewal application process. The scope of the GALL-SLR and SRP-SLR documents is to: (i) describe methods acceptable to the NRC staff for granting a subsequent license renewal (e.g., a renewal beyond the initial 60-years) in accordance with license renewal regulations, and (ii) describe the techniques used by the NRC staff in evaluating applications for subsequent license renewal. The commenter's concerns are therefore beyond the scope of these documents.

Source 031: Wallace Taylor—General Comment

Comment: 001

See attached file(s)

Attachments

Nuclear license renewal comments by Wallace Taylor provided the comment letter of February 29, 2016 (ADAMS Accession No. ML16068A067).

RESPONSE:

The first issue raised by the commenter is concern about safety from subsequent license renewals, specifically, that plants designed for a 40-year operational period were not designed for operation up to 60- or 80-year terms. As noted by the commenter, The Atomic Energy Act (AEA) of 1954, as amended, authorizes the NRC to issue 40-year initial licenses and, upon application and approval, subsequently renew licenses for nuclear power reactors. The NRC's decision as to whether to permit these licenses to be renewed beyond the initial 40-year term for an additional 20-year increment (per renewal) is based on the outcome of an assessment to determine if the nuclear facility can continue to operate safely during the proposed period of extended operation. The scope of the GALL-SLR and SRP-SLR documents is to: (i) describe methods acceptable to the NRC staff for granting a subsequent license renewal (e.g., a renewal beyond the initial 60-years) in accordance with license renewal regulations, and (ii) describe the techniques used by the NRC staff in evaluating applications for subsequent license renewal. The issues raised by the commenter with regard to safety concerns at individual plants would be addressed as part of licensing actions, inspections, or other plant-specific regulatory actions.

Secondly, the commenter raises concerns about the continued generation of spent nuclear fuel in the absence of a disposal facility. The commenter correctly notes that this issue was addressed in the NRC's Continued Storage Spent Fuel Rule in 10 CFR 51.23. The purpose of the rule was to address the agency's obligations under the National Environmental Policy Act (NEPA) with respect to the environmental impacts of continued storage (e.g., storage of spent nuclear fuel beyond the licensed life of operations for a reactor). In the 2014 rulemaking, the Commission generically determined that the environmental impacts of continued storage are those impacts identified in NUREG–2157, ''Generic Environmental Impact Statement or Continued Storage of Spent Nuclear Fuel'' (GEIS). The revised rule clarified that license renewal applicants do not need to address continued storage in their environmental report, but rather can incorporate by reference the impacts from NUREG–2157, as long as they are relevant to the proposed action. However, the rule at 10 CFR 51.23 addresses only the continued storage period, which is the period beyond licensed life, whereas the findings of a site-specific environmental review may be challenged during the initial licensing of a facility or during license renewal. The issue of the technical feasibility and availability of a geologic repository is addressed in Appendix B of the GEIS. Therefore, the issue regarding the absence of a disposal facility are beyond the scope of the GALL-SLR and SRP-SLR documents.

Third, the commenter discusses the availability of renewable energy as an alternative to subsequent license renewal. The NRC is an independent agency that was established to regulate the nation's civilian commercial, industrial, academic, and medical uses of nuclear materials. The NRC does not license or regulate sources of energy other than nuclear power. Further, the NRC does not shape national energy policy or promote any source of energy. National energy policy is established by Congress and the President and is outside the scope of the NRC's statutory responsibilities. Therefore, the comments about renewable energy are beyond the scope of these documents.

With regard to the commenter's conclusion that subsequent licensing of reactors violates the NRC's duty to protect the public and the environment, the NRC is committed to providing a comprehensive regulatory framework that assures the safe civilian use of radioactive materials. The NRC assures safety and addresses issues at operating plants through a combination of regulatory requirements; licensing; safety oversight, including inspection, assessment of performance, and enforcement; operational experience evaluation; and regulatory support activities. The GALL-SLR and SRP-SLR are part of an NRC effort to ensure that issues unique to subsequent license renewal are adequately addressed.

Source 032: Michel Lee—General Comment

Comment: 001

The entire edifice of the scheme rests upon the false construct that the NRC can predict the effects of aging in systems which have not yet had experience with significant aging. This assumption would be shaky even if licensing–and relicensing–were limited to a year or two. It is preposterous with respect to the prolonged durations envisioned in the NRC's regulatory scheme.

As a preliminary point, it bears mention that the Fukushima-Dajichi meltdown occurred in the site's 41st year, in the aftermath of a 10 year relicensing authorization. Regardless of the contribution of aging at that site, it begs the question: What would have been the scale of the disaster had the accident occurred during the plant's 51st or 61st or 71st year?

Aging management is conflated with assurance of safe performance during extended operation. The NRC's entire schema is based on hypothesis, not validated experiential whole system operational data.

Understanding of the effects of aging–for any complex installation, much less one operating under conditions of extreme pressure, heat and radioactivity–requires substantial accumulation and analysis of evidence of the actual performance of many such installations under real world conditions for many years. As a matter of irrefutable fact, there exists no such evidence for aged nuclear plants. The US fleet of reactors is largely either approaching or just near past 40 years of operation. There is no way to know how even the most robust well maintained plants will respond under duress of time.

For the many U.S. plants which have already had significant and repeated operational problems, the added variable of decades is a sure multiplier of uncertainty.

Indian Point, for example, in its first 40 years of operation has already had multiple fires, explosions, cooling system malfunctions, clogged water intakes, boric acid corrosion, reactor control rod malfunctions, emergency backup generator failures, emergency communication system failures, computer software problems, pipe breaks, and radiation leaks. In the past year alone, the site experienced a transformer fire, an alarm failure, a power failure in the reactor core, and a new tritium leak. An NRC Special Inspection Team dispatched to Indian Point following the plant's most recent transformer explosion, fire and oil leak–which occurred on May 9, 2015–determined that valves in the switchgear room designed to open to spray water malfunctioned because parts were corroded and clogged with debris. The valves leaked water into the switchgear room, and the water pooled because the drain on the floor was partially clogged with debris. (Special Inspection Report 05000286/2015010, Jul 23, 2015.) We should not need to remind the NRC of the risks inherent in the flooding of a switchgear room. Submersion of electrical components could disable switchgears and lead to station blackout or worse.

The NRC compiles information on degradation of components and systems (C&S) taken from studies on discrete C&S and specific plant findings. The NRC no doubt also does its best in the Proposed Rule to incorporate lessons learned. But when, where, and how does the NRC audit its own overall pattern of prediction performance? As far as we can tell, there has never been such an audit, nor does the agency appear to recognize such critical evaluation is an imperative. Alternatively, if such an audit has been conducted in recent years, the public deserves to know the results.

Source 032

Profound trust in unflagging foresight is further unwarranted given the multiple uncertainties inherent in nature and climate change. The NRC cannot seriously contend, for example, that climate change would not exert a multiplier effect on the aging mechanisms applicable to reactors, spent fuel pools, and ancillary support C&S. For a wide assortment of risks–flooding risk, dam failure risk, earthquake risk, landslide risk, hurricane risk, tornado risk, site fire risk, and wildfire risk–small risks can grow pretty exponentially when combined and when the time periods are long.

Modest, even minor degradation of discrete C&S may not, in and of themselves present significant risk, but the NRC scheme fails to consider the potential risks inherent in a site bearing multitudes of “acceptably” degraded C&S, especially under high load pressures such as a beyond design basis event leading to prolonged accident conditions.

Again, imagine if Fukushima had experienced another decade or two of normal aging before mother nature struck its devastating blow.

Plants like Indian Point are disasters waiting to happen. Aging of increasingly deteriorated reactors is not going to be magically eradicated by piecemeal modifications and patches. As former NRC chairman, Gregory B. Jaczko, most aptly put it:

“Continuing to put Band-Aid on Band-Aid is not going to fix the problem.”

RESPONSE:

The U.S. Nuclear Regulatory Commission (NRC) has a robust regulatory framework to ensure safety both for new nuclear power plants and for those undergoing license renewals. NRC’s program includes site-specific licensing reviews and ongoing inspection and enforcement programs to ensure that NRC licensees continue to meet the NRC’s safety standards. The NRC addresses issues through safety oversight, assessment of performance, and enforcement; operational experience evaluation; and regulatory support activities. Regardless of the period of operation, nuclear power plant operators must still meet NRC requirements and standards, conduct inspections, and develop aging management programs, as necessary. NRC has dedicated significant resources to understanding the effects of aging on nuclear power plant performance, and, with this information, has developed or compiled many regulatory guides, standard review plans, technical reports, and Nuclear Plant Aging Research (NPAR) Reports. As new information is gained from operational experience, NRC incorporates and applies these “lessons learned” to adjust its activities (e.g., inspections and other oversite) as warranted. Indeed, such “lessons learned” information is instrumental to this update to the Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report and Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SLR-SRP) documents.

Regarding the commenter’s concern about internal auditing of NRC’s ability to predict performance, each license renewal includes an assessment of plant performance and aspects of the facility that have changed since its previous license was granted. Furthermore, individual plant operational experience and documents such as the GALL-SLR and SLR-SRP are used to ensure that assumptions made for initial licenses and performance during the licensed period are appropriately considered in any renewals. However, this issue is beyond the scope of the GALL-SLR and SLR-SRP documents.

Finally, regarding the commenter’s concern about effects of climate change on nuclear power plants, particularly with regard to potential natural hazards, the NRC considers such effects as part of the environmental review conducted under the National Environmental Policy Act (NEPA). This review occurs both at initial licensing and license renewal, and covers the period of time for operating license. Environmental impacts on nuclear fuel that is stored beyond the licensed life of operations for a reactor, including those impacts from natural hazards and climate change, were considered in the GEIS for Continued Storage (NUREG–2157). This issue is also beyond the scope of the GALL-SLR and SLR-SRP documents.

Source 033: Wolf Creek Nuclear Operating Corporation—AMPs X.M1, XI.M1, XI.M3, XI.M11B, XI.M12, XI.M16A, XI.M17, XI.M18, XI.M42, XI.S1, XI.S3, XI.S5, XI.S6, XI.S7, XI.E6

Comment: 001

Wolf Creek Nuclear Operating Corporation has submitted comments regarding Subsequent License Renewal guidance documents in the attached file ET16-0010.

Attachments

ET16-0010

General Comments:

1. Little or no credit is given to the existing programs that were committed to in the original License Renewal Applications (LRAs). The wording seems to indicate that licensees are starting from "ground zero", rather than updating the Aging Management Programs (AMPs) from the original period of extended operation (PEO) with current operating experience (OE).

RESPONSE:

The staff partially agreed with the comment. The aging management program (AMP) descriptions were revisions from the AMPs in GALL Report Revision 2. For some plants that were licensed using GALL Report Revision 2, there may be little change required. For some plants that were licensed pre-GALL or using GALL Revision 1, the applicants may be starting from "ground zero. No change was made.

Comment: 002

Wolf Creek Nuclear Operating Corporation has submitted comments regarding Subsequent License Renewal guidance documents in the attached file ET16-0010.

Attachments

ET16-0010

General Comments:

2. Additional inspections/monitoring that are being made requirements for the subsequent PEO, which were above and beyond those for the original PEO have little or no justification provided. Including:

    a. Perform ultrasonic thickness (UT) measurements of the containment shell or liner surfaces inaccessible from one side on a random and focused basis each 10 year interval. (XI.S1)

b. Perform surface examination of stainless steel (S3) material and dissimilar welds of penetration sleeves and penetration and vent line bellows every 10 years regardless of cyclic loading, stress corrosion cracking (SCC), or whether a current licensing basis fatigue analysis exists. (XI.S1)

c. Inspect an additional 5% American Society of Mechanical Engineers (ASME) Section XI, Subsection IWF piping supports for class I, II, and Ill every 10 years. (XI.S3)

d. Visual inspection all ASME Section XI, Subsection IWF bolts; and volumetric examination of ASTM A325, A490, F1852, and F2280 bolts every 10 years. (XI.S3)

e. UT of high strength bolts every 5 years on Refueling Crane structural members. (XI.M23)

f. Increased frequency inspection every 3 years (vs. 5 years previously) for unbraced and unreinforced masonry walls. (XI.S5)

g. New requirement–seasonally perform through-wall leakage or groundwater infiltration quantification and chemistry analysis.. (XI.S6) (XI.S7)

h. Perform focused inspections of below grade inaccessible concrete exposed to aggressive groundwater/soil every 5 years frequency. (XI.S6) (XI.S7)

i. Testing of in scope inaccessible non-environmentally qualified (EQ) instrumentation & control cables every 6 years. (XI.E3B)

j. Testing of in scope inaccessible low voltage (below 400v) every 6 years. (XI.E3C)

k. Increased metal enclosed bus bolted inspection testing from a 20% sampling to 100% every 10 years. (XI.E4)

l. Change non-EQ connection testing from one-time testing before the PEO to periodic testing every 10 years. (XI.E6)

m. Class 1 pump casings should continue to be exempt similar to valves bodies. Both pump casings and valve bodies are adequately managed by ASME Code inspection requirements. (XI.M12)

RESPONSE:

For Item 2 above, the staff did not agree with the comment. Additional inspections and monitoring will be required for the subsequent period of extended operation to address additional aging due to the longer term exposure to high temperature, high radiation, and longer term exposure to an adverse environment.

The listed items a – m above are verbatim repeats of the National Energy Institute (NEI) Significant Summary comments addressed earlier in this document under Source 014. The responses to these comments are referenced as follows:

a. See the response to Comment 014-012.

b. See the response to Comment 014-013.

c. See the response to Comment 014-014.

d. See the response to Comment 014-015.

e. See the response to Comment 014-016.

f. See the response to Comment 014-017.

g. See the response to Comment 014-018.

h. See the response to Comment 014-019.

i. See the response to Comment 014-020.

j. See the response to Comment 014-021.

k. See the response to Comment 014-022.

l. See the response to Comment 014-023.

m. The staff partially agreed with this comment and recommended changes to the GALL-SLR Report have been made. The staff modified the AMP to include a visual inspection and test frequencies are adjusted based on inspection and test results, as well as, plant-specific operating experience.

   The exemption of pump casings was based upon implementation of Code Case N-481 requirements by licensees, which included a VT-3 when pumps were disassembled of the pump interior, VT-2, and VT-1 exam of one pump weld. In addition, Code Case N-481 required a "safety and serviceability evaluation." When Code Case N-481 was withdrawn, some but not all the requirements of the code case were incorporated into the ASME Code, Section XI. Therefore, since some of the requirements, specifically the VT-1 examination and the safety and serviceability evaluation, were not incorporated into Section XI, the staff determined it was appropriate for pump casings to be subject to the same requirements as piping components. The basis for exempting valve bodies from the requirement for screening was different than that for pumps. A generic flaw tolerance evaluation was used as the basis for exempting valve bodies, not Code Case N-481. Therefore, valve bodies continue to be exempt from screening in AMP XI.M12 for SLR.

Comment: 003

Wolf Creek Nuclear Operating Corporation has submitted comments regarding Subsequent License Renewal guidance documents in the attached file ET16-0010.

Attachments

ET16-0010

Source 033

General Comments:

3. Inspection criteria in several cases are overly restrictive:

   a. Containment liner bulge evaluation. (XI.S1)

   b. Change to ASME Section XI, Subsection IWL program to record and trend cracking without any threshold of significance. (XI.S2)

   c. Inspecting for surface discontinuities and imperfections, and clearances and physical displacement for signs of loose joints is overly prescriptive. Inspection for signs of leakage should be sufficient, especially for non-safety related bolting. (XI.M18)

   d. Surface examinations for aluminum and SS cracking are not necessary. Cracking can be seen visually prior to loss of intended function. Additionally, surface examinations for opportunistic inspections are overly burdensome. (XI.M38)

   e. Need increased flexibility for further evaluations of alkali-silica reaction (ASR), and the threshold for plant specific and potential actions should be identified. (XI.S6)

RESPONSE:

The listed items a – e above are summaries of the NEI comments addressed earlier in this document. The responses to these comments are referenced as follows:

a. See the response to Comment 019-044.

b. See the response to Comment 019-050.

c. See the response to Comment 014-008.

d. See the response to Comment 014-010.

e. See the response to Comment 019-074.

<u>Comment: 004</u>

AMP No.: X.M1

AMP Title: Cycle Load Monitoring

Program Description: Allow the use of NUREG/CR-5709 for stainless steel components, or NUREG/CR-6583 for carbon and low alloy steel components since each was deemed acceptable in GALL Rev 2 for evaluating environmental fatigue.

RESPONSE:

The staff did not agree with this comment and no changes were made to the GALL-SLR Report. The GALL-SLR specifies the NUREGs that the staff considers acceptable for use.

<u>Comment</u>: <u>005</u>

AMP No.: XI.M1

AMP Title: ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWO

Program Description: Recommend deletion of wording to a specific year edition and addenda and replace with “in accordance with applicable plant ASME Code Section XI edition(s) and approved addenda.”

RESPONSE:

The NRC cannot reference documents that do not have a date or revision number. Without a reference to a date or revision number, the staff cannot ensure that all versions will provide adequate technical basis for the aging management practices in this AMP.

<u>Comment</u>: <u>006</u>

AMP No.: XI.M3

AMP Title: Reactor Head Closure Stud Bolting

2. *Preventive Actions*: If plants have taken exceptions to actual yield strength less than 150 ksi for 40 to 60 year license renewal application, continuing to recommend this limitation (less than 150ksi) for studs fabricated prior to 2010 is unnecessary and will result in unnecessary declarations of exceptions in the future SLR applications.

RESPONSE:

The staff partially agreed with this comment and the recommended changes to the GALL-SLR Report have been made. In a meeting held on March 24, 2016, the panel decided to retain element 2(d) but adding additional text to include 170 ksi ultimate tensile strength for existing studs.

Staff agreed to add 170 ksi UTS for existing bolting in order to reduce unnecessary exceptions to the GALL-SLR Report AMP XI.M3, “Reactor Head Closure Stud Bolting.” Staff has previously accepted the exception to the 150 YS for closure bolting based on the expected non-destructive examination of the studs, and the available industry operating experience (i.e., confirmed stress corrosion cracking (SCC) of closure studs has not occurred for closure studs with a measured maximum UTS less than 170 ksi).

<u>Comment</u>: <u>007</u>

AMP No.: XI.M11B

AMP Title: Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components

4. *Detection of Aging Effects*: A baseline volumetric exam of all susceptible material nickel alloy bottom mounted instrument nozzles may not be possible due to geometry/accessibility of the components. Industry visual examinations have been proven

capable of detecting relevant indications before the effects of aging progress to point of causing a loss of intended function. This action is not required.

RESPONSE:

The staff agreed with the comment. In this comment disposition, the staff also considered the discussions held during public meetings regarding subsequent license renewal guidance documents (e.g., April 26, June 1 and 23, and July 26, 2016). The baseline examination provision for BMI nozzles is deleted.

Comment: 008

AMP No.: XI.M12

AMP Title: Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)

Program Description: Per letter May 19, 2000 from Christopher Grimes (NRC) to Douglas Walters (NEI) screening for susceptibility to thermal aging embrittlement is not required for pump casing and valve bodies. Existing ASME Code Section XI inspection requirements are adequate for pump casings and valve bodies. Recommend deleting the requirement to screen pump casing for thermal aging embrittlement.

RESPONSE:

The staff partially agreed with this comment. The exemption of pump casings was based upon implementation of Code Case N-481 requirements by licensees, which included a VT-3 when pumps were disassembled of the pump interior, VT-2, and VT-1 exam of one pump weld. In addition, Code Case N-481 required a “safety and serviceability evaluation.” When Code Case N-481 was withdrawn, some but not all the requirements of the code case were incorporated into the ASME Code, Section XI. Therefore, since some of the requirements, specifically the VT-1 examination and the safety and serviceability evaluation, were not incorporated into Section XI, the staff determined it was appropriate for pump casings to be subject to the same requirements as piping components. The basis for exempting valve bodies from the requirement for screening was different than that for pumps. A generic flaw tolerance evaluation was used as the basis for exempting valve bodies, not Code Case N-481. Therefore, valve bodies continue to be exempt from screening in AMP XI.M12, “Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS),” for SLR. (Also see the response to the similar Comment 016-052)

Comment: 009

AMP No.: XI.M16A

AMP Title: PWR Vessel Internals

This AMP has been deleted. EPRI 1022863, “Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)” is based on a program for licensees' first PEO (i.e., 40-60 years). However, MRP-227-A is a living program and is informed based on latest OE. Therefore, it is recommended that MRP-227-A be included as a generic starting point to manage aging for the reactor vessel internals.

RESPONSE:

This comment is analogous to Comment 014-001. The staff agreed with this comment and recommended changes to the GALL-SLR Report have been made. The staff agreed that an AMP that employs the methodology in Topical Report No. MRP-227-A may be used as the starting point for an AMP that will be used to manage the aging effects of PWR vessel internals, as long as it is supplemented with a submittal of a gap analysis methodology that identifies the potential changes that may need to be made to the methodology in MRP-227-A in order to account for the additional 20 year of licensed operations that would occur during a subsequent period of extended operations (i.e., to account for a total of 80 years of licensed operations. For more information, refer to the staff's bases for resolving the comment associated with Comment 014-001.

Comment: 010

AMP No.: XI.M17

AMP Title: Flow-Accelerated Corrosion

6. *Acceptance criteria*: While a suggested safety factor for acceptable wall thickness and remaining life of 1.1 is recommended in the industry guidance document, this safety factor should not be included as a regulatory requirement.

RESPONSE:

The staff disagreed with this comment. The GALL-SLR Report has not been changed.

To be clear, the inclusion of a specific safety factor in a GALL-SLR Report AMP does not translate into a "regulatory requirement." However, by specifying a safety factor in an AMP, the use of a safety factor different than that specified would prompt an applicant to cite an exception, which allows licensees to provide their technical justification for its use, like any other exception to an AMP. The staff notes that NSAC-202L, Revision 4 states "The minimum Safety Factor should never be less than 1.1, [emphasis added]" and consequently, if an applicant intends to use a safety factor less than 1.1, the staff should be aware of this position and should evaluate the technical adequacy of the lesser number.

Comment: 011

AMP No.: XI.M18

AMP Title: Bolting Integrity

4. *Detection of Aging Effects*: Little justification is provided to increase the inspection of bolts in locations that preclude detection of joint leakage beyond the requirement of bolt heads are inspected when accessible and bolt threads are inspected when joints are disassembled to require a minimum of in each 10 years inspect a minimum of 20% of the population of bolts heads and threads per material and environment with a maximum of 25.

Source 033

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

The Callaway safety evaluation report for license renewal, NUREG–2172, Section 3.0.3.2.2 (ML15068A342) documents the development of the staff position for managing the effects of aging for normally inaccessible bolting. Given the practical limitations to inspecting such bolting, the staff ultimately determined that reasonable assurance that the effects of aging will be managed could be obtained through a combination of component performance monitoring (as applicable), opportunistic visual inspections, and a backstop that assures that a minimum sample of bolting is periodically inspected.

The staff concluded that closure bolt threads should be inspected in addition to closure bolt heads to ensure that unseen degradation is not occurring. The staff recognizes that bolt head could be visible during routine maintenance; however, not all maintenance activities require disassembly of the bolted joint. The sample size of 20 percent of closure bolts with a maximum of 25 closure bolts is a standard inspection quantity for sampling-based programs as established in both GALL Report Revision 2 and the GALL-SLR Report (e.g., AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components").

Comment: 012

AMP No.: XI.M42

AMP Title: Internal Coatings /Linings for In Scope Piping, Piping Components, Heat Exchangers, and Tanks

7. *Corrective Action*: In regards to repair of blisters, the requirement to conduct physical testing if the blisters are not repaired can result in more damage to the coatings than just leaving the blisters. It is recommended the wording be revised to include lightly tapping the surrounding coating to determine the soundness of the coating.

RESPONSE:

The staff partially agreed with this comment. The staff revised the recommendation related to physical testing of blisters to make it clear that it only applies when the acceptance criteria are not met.

Adhesion testing other than lightly tapping can be conducted without damage to the coating. The staff agreed that even though adhesion testing without damage is possible, it should not be necessary to conduct adhesion testing when the potential for coating degradation to affect the intended function of an in-scope component is low. To that end, it was the staff's intent that the Corrective Action program element fifth paragraph related to blisters that are not repaired be only applied when the blister(s) does not meet the acceptance criteria.

The staff has concluded that if the blisters are not: (a) few in number; (b) small; and (c) completely surrounded by sound coatings/lining bonded to the substrate; or the blister size or frequency are increasing between inspections, the "corrective actions" program element statement is appropriate to ensure that potential further degradation will not affect the intended function of an in-scope component. The staff revised the fifth paragraph to make it clear that it only applies when the acceptance criteria are not met.

During its review of this comment, the staff noted that the term “and” in “[b]lister size and frequency should not be increasing between inspections should have been “or.” Either of the changes, size or frequency, would be an indication of continuing degradation of the coating. The change was incorporated.

Comment: **013**

AMP No.: XI.S1

AMP Title: ASME Section XI, Subsection IWE

4. *Detection of Aging Effects*: ASME Section XI, Subsection IWE only requires augmented inspections (i.e., UT measurements) for “surface areas subject to accelerated degradation and aging.” The additional requirement to UT containment shell or liner surfaces inaccessible from one side at random locations, regardless of whether or not those areas are subject to accelerated degradation is not warranted. This requirement is beyond the ASME Code and 10 CFR 50.55a requirements and no technical basis exists for this inspection. This requirement will add significant dose and cost and little safety benefit.

RESPONSE:

The staff partially agreed with the comment. The related descriptions in the Program Description and Detection of Aging Effects program elements of GALL-SLR Report AMP XI.S1, “ASME Section XI, Subsection IWE,” have been revised considering the comment, in order to base the recommendation for supplemental ultrasonic testing (UTs) based on a trigger of plant-specific operating experience.

The last sentence in the last paragraph of the “Program Description” of AMP XI.S1 has been revised as follows:

> The program is also supplemented to perform surface examination’ of pressure-retaining components that are subject to cyclic loading but have no current licensing basis (CLB) fatigue analysis; and, based on plant-specific OE, a one-time volumetric examination of metal shell or liner surfaces that are inaccessible from one side, ~~during each inspection interval.~~

The last paragraph of the “Detection of Aging Effects” program element of AMP XI.S1 has been revised as follows:

> The requirements of ASME Section XI, Subsection IWE and 10 CFR 50.55a are further supplemented to require a one-time volumetric examination of metal shell or liner surfaces that are inaccessible from one side, only if triggered by plant-specific operating experience ~~during each inspection interval~~. The trigger for this supplemental examination is plant-specific occurrence of any instance of metal shell or liner corrosion initiated on the inaccessible side or areas, since the date of issuance of the first renewed license. ~~The~~ This supplemental volumetric examination consists of ~~(1) a sample of one-foot square randomly selected locations and (2)~~ a sample of one-foot square locations that included both randomly-selected, and focused ~~on~~ areas most likely to experience degradation based on operating experience and/or other considerations such as environment. Any identified degradation is addressed in accordance with the applicable provisions Subsection IWE. The sample size, locations, ~~frequency and schedule~~ and any needed

scope expansion for ~~each~~ this one-time set of volumetric examinations should be determined on a plant-specific basis ~~during each interval~~ to demonstrate statistically with 95 percent confidence that 95 percent of the accessible portion of the containment liner is not experiencing corrosion degradation with greater than 10 percent loss of nominal thickness. Guidance provided in EPRI TR-107514 may be used for sampling considerations.

Comment: **014**

AMP No.: XI.S3

AMP Title: ASME Section XI, Subsection IWF

4. *Detection of Aging Effects*: No technical basis or applicable OE was provided to require an additional 5% of ASME Section XI, Subsection IWF piping supports beyond the ASME Code requirements to be examined. These additional examinations will add significantly to the scope and increase dose.

RESPONSE:

The staff partially agreed with the comment and associated changes to the GALL-SLR Report have been made. See the detailed response to the similar previous Comment 019-036.

Comment: **015**

AMP No.: XI.S5

AMP Title: Masonry Walls

4. *Detection of Aging Effects*: No technical basis or applicable CE was provided for the inspection frequency requirements of every 3 years for unreinforced and unbraced masonry walls.

RESPONSE:

The staff agreed with this comment and associated changes to the GALL-SLR Report have been made. Wording in the AMP was changed to:

> Visual examination of the masonry walls by qualified inspection personnel is sufficient. In general, masonry walls are inspected every 5 years. Provisions exist for more frequent inspections in areas where significant loss of material, cracking, or other signs of degradation are observed to provide reasonable assurance that there is no loss of intended function between inspections.

<u>Comment</u>: <u>016</u>

AMP No.: XI.S6

AMP Title: Structures Monitoring

4. Detection *of Aging Effects*: Change to ground water monitoring frequency to address potential seasonal variations (e.g., quarterly or semi-annually) is overly proscriptive and provides little or no value and should remain at the 5-year interval.

RESPONSE:

The staff partially agreed with the comment and the recommended changes to the GALL-SLR Report have been made. See the related response to the similar previous Comment 019-068.

The discussion in element 4 regarding corrective actions was replaced with wording recommending an assessment of possible aging effects caused by groundwater in-leakage. Additionally, the word "may" was added to the guidance in element 4 related to what information should be included in the assessment.

Requiring monitoring of volume and chemistry is not overly prescriptive. There is significant operating experience from recent license renewal application reviews with licensees finding through-wall leakage acceptable as-is with little or no evaluation. The staff does not consider through-wall leakage acceptable and expects some form of assessment to be completed when leakage is identified. Furthermore, the staff did not agree that monitoring the leakage is not feasible and that monitoring does not provide useful data. Significant changes in the volume or chemistry data of the leakage could be a leading indicator of concrete or reinforcing steel degradation. The guidance allows licensees to determine the appropriate parameters monitored along with the frequency of the monitoring and to determine what additional actions need to be taken based on the results of monitoring.

<u>Comment</u>: <u>017</u>

AMP No.: XI.S7

AMP Title: Inspection of Water-Control Structures Associated with Nuclear Power Plants

4. Detection of Aging Effects: Changes to ground water and raw water monitoring frequency to address potential seasonal variations (e.g., quarterly or semi-annually) are overly proscriptive and provide little or no value and should remain at the 5-year interval.

RESPONSE:

See the detailed response to the similar previous Comment 014-017.

<u>Comment</u>: <u>018</u>

AMP No.: XI.E6

AMP Title: Electrical Cable Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Source 033

Program Description and 4. *Detection of Aging Effects*:

Little or no justification to change the requirement from one-time testing to periodic testing on a 10-year basis.

RESPONSE:

The staff partially agreed with this comment and the recommended changes to the GALL-SLR Report have been made. The findings of the initial one-time test are evaluated to determine whether periodic testing of the cable connections are warranted. This finding forms the basis of site-specific operating experience for age-related degradation and informs the need for subsequent testing on a 10-year periodic basis. The justification and technical basis for not performing subsequent periodic testing is documented. This includes a discussion of the types of unacceptable conditions or degradation identified and whether they were determined to be age-related, requiring periodic maintenance.

Source 034: Donna Gilmore—General Comment

Comment: 001

From: Donna Gilmore <dgilmore@cox.net>

Sent: Sunday, February 28, 2016 12:40 PM

To: Gallagher, Carol

Subject: [ExternalSender] Subsequent License Renewal Comment Docket ID NRC-2015-0251

RE: Docket ID NRC-2015-0251

The current inability to inspect and adequately maintain critical aging structures and components means any current aging management plan is inadequate. Until those issues are resolved it is premature to consider licensing or relicensing any nuclear reactors.

How can you have aging management for critical structures and components that cannot be inspected? These components were designed for 40 years. The critical issues discussed in the 1/27/2016 NRC meeting referenced below, in the GALL report and all other known critical issues should be resolved before approving licensing or relicensing of any reactors. An aging management plan with promises of future solutions to inspect and maintain is a plan for failure.

http://www.nrc.gov/reactors/operating/licensing/renewal/introduction/safetv/safety3.html

http://pbadupws.nrc.gov/docs/ML1601/ML16014A689.pdf

http://pbadupws.nrc.gov/docs/ML1034/ML103490041.pdf

Donna Gilmore

SanOnofreSafety.org

Docket link: http://www.regulations.gov/#!documentDetail;D=NRC-2015-0251-0004

RESPONSE:

NRC regulations at 10 CFR 50.65 (commonly referred to as the maintenance rule) provides requirements for monitoring the effectiveness of maintenance at nuclear power plants, and describes how safety-related structures, systems, and components are subject to monitoring and maintenance activities. Licensees are required to take appropriate corrective action when the performance or condition of a structure, system, or component (SSC) does not conform to established goals. All licensees have specific aging management programs to inspect, monitor, detect, and trend the aging of certain components of nuclear power plants. These requirements are applicable throughout the life of the facility license, from operation through decommissioning. Licensees must include aging management programs in their renewal applications to manage issues associated with aging that could adversely affect structures, systems, and components important to safety (including corrosion). Licensees must also include time-limited aging analyses that demonstrate that structures, systems, and components important to safety will continue to perform their intended functions for the requested period of extended operation. The scope of the assessment may be limited to SSCs that a risk-informed evaluation process has shown to be significant to public health and safety.

Some parts of nuclear power plants are inaccessible while the reactor is operating, but may be inspected during outage periods. In the meetings referenced by the commenter, the discussion centered on how to improve the requirements of license renewal aging management programs. The programs include “inservice inspections,” where representative portions of a system or component are evaluated to determine overall condition or performance.

Finally, the NRC is committed to ensuring adequate protection of public health and safety. The purpose of the updates to the GALL-SLR and SLR-SRP is to incorporate lessons learned from operational experiences and aging management programs and provide information about where aging management programs should be augmented for subsequent license renewals. Regardless of the operational period, the licensees must demonstrate that NRC regulations have been and will continue to be met.

Source 035: Meghan Belaski—General Comment

Comment: 001

Upon hearing the news that the invisible arm of our decrepit and derelict nuclear industry is seeking additional life-support for its brain-dead facilities around the U.S., in order to extend the life-span beyond original design capabilities, makes perfect sense in the regulatory environment the NRC has long operated in, and is obviously quite troubling given the past and current histories of many of the plants that are seeking this extension from the NRC today, likely resulting in a catastrophic event in the future when a site finally pulls the plug on itself if these DNR's are ignored now, and brought back to life without cause.

On a regular basis, too often in fact, the public is made aware of the stark realities of the degrading nature of our nuclear power plants around the U.S, due to crumbling nuclear infrastructure which includes failing power lines, back-up generators and pump system failures, radioactive flooding, fires, shut-downs, or scrams, IT systems from the 8-track era, known structural defects, falsified safety records, and failures to report incidents to the NRC, the fact almost none of these plants can stand up to a snowstorm, while sea-waters are rising, and maintaining the financials of an industry that apparently went bankrupt some time ago when no one was looking, is a curiosity to say the least. And in these proposed extensions are taxpayer monies propping up this dying industry, focused on 1 energy “solution” to global warming, at maximum cost, when the same taxpayer monies could fund multiple sources of RENEWABLE energy for half the cost *a* nuclear build or lifeline could ever offer. And it won't make you a nuclear refugee either.

This is a crime against America. Why aren’t we demanding to know why we are being asked to further fund an industry that doesn’t really know how to explain to the public much of anything about the life-cycle of our nuclear anthro-pocene? It’s actually quite odd if you really think about it. How is nuclear “power” of any type so misunderstood by its own creators? How is it that scientists, who apparently harnessed this unrealized universal force, working for year from the onset of the Manhattan Project, to right now, didn’t pass on the science that would implore us to properly administer a cradle-to-grave understanding and handling of the most lethal material and force known to man, even if it’s packaged in industry soundbites as the ONLY way to save earth from climate disaster? These people are crazy. Seriously crazy.

I don’t care if Bill Gates et al., say nuclear is the next energy miracle. He’s wrong, and I would implore that he and the Foundation go spend a few weeks in Fukushima and Chernobyl, and press those numbers. Then come back and apply the same scenario to the most densely populated American cities within a similar radius to a nuclear plant and see what you come up with. No people. Abandoned cities. No agriculture. Polluted water. Cancers for generations and you’re worried about Syrian refugees invading your borders folks? Just wait until you’re a displaced American within America from a nuclear fallout incident, and 20 million people end up living where precisely? Where they work? Re-build lives? Cause they'll never go home. You’ll find out very quickly that the Syrian friend was a better option. Consider us lucky for now. But forewarned later.

If I was to use an analogy to conjure up a vision about what this might look like, I thought about my first car. I was 16 in 1992. My parents bought me a “classic” automobile; a 1963 Ford Falcon in mint condition. My father was meticulous about the car, and took extra-special care of it in order to keep it “road-worthy”. Even though the 1963 Falcon was in mint condition, it still was not as fast, powerful or reliable as the rest of the newer cars on the road in 1992 and I had to drive a little differently than everyone else on the road. But again this was 1992, and the cars certainly were not as fast or technologically advanced as they are now.

This is what I see the NRC proposing with these extensions for the nuclear industry. Puffing a “classic” on the road while all the rest of the modern world and technology outpaces your broke-down and lethal energy source that, if it doesn't kill you instantly when a nuclear power falls-out in the USA, will kill generations of our families slowly and painfully from the radiation exposure from this revolutionary clean energy source.

How is that we’ve let this become the only answer to climate change? It’s not people. It’s time to wake up and face the facts. Please do not extend the lifeline of these nuclear facilities. They are liabilities we cannot afford. It’s time to fund innovative energy sources for our times. If Applebee’s in California has to tell me some of their food may have ingredients that cause cancer, then apparently this industry has been kept alive by artificial means for 70 years too long now, and it’s time to pull the plug.

RESPONSE:

The staff acknowledges the comment is opposed to the continued use of nuclear power and renewal of nuclear power plant licenses; however, these comments are beyond the scope of the GALL-SLR and SLR-SRP documents, which (i) describe methods acceptable to the NRC staff for granting a subsequent license renewal (e.g., a renewal beyond the initial 60-years) in accordance with license renewal regulations, and (ii) describe the techniques used by the NRC staff in evaluating applications for subsequent license renewal.

The NRC does not shape national energy policy or promote any source of energy. Under the Atomic Energy Act (AEA) and the Energy Reorganization Act of 1974, the NRC has broad authority to grant, suspend, revoke, or amend licenses for licenses for utilization facilities (e.g., nuclear power reactors) and to grant, suspend, revoke, or amend materials licenses based on the NRC’s consideration of, among other factors, public health and safety. In addition, the NRC was created and is overseen by Congress and the President. Should Congress and the President determine that the best interests of the United States would be served by a change in nuclear energy policy, Congress and the President have the authority to change that policy in any direction they believe appropriate, limited only by the Constitution. Through the AEA, Congress has mandated that the NRC establish criteria to allow the licensing of nuclear power plants.

Regarding the commenter’s concerns about plant nuclear power plant infrastructure safety, the NRC is committed to ensuring the safe use of radioactive materials for beneficial civilian purposes while protecting people and the environment. The NRC does this through a robust regulatory framework that includes license requirements, inspections, oversight, performance assessment, and enforcement.

Finally, the NRC strives to conduct its regulatory responsibilities in an open and transparent manner, consistent with the NRC Approach to Open Government. To ensure objectivity and independence in its regulatory activities, the NRC and the U.S. Office of Government Ethics have stringent rules and procedures to ensure that employees of and advisors to the NRC are free of conflicts of interest and the appearance of conflicts of interest.

Source 036: Marvin Lewis—General Comment

Comment: 001

From: Marv Lewis <marvlewis@juno com>

Sent: Tuesday, March 01, 2016 12:02 AM

To: Gallagher, Carol; Brady, Bennett; regulations.govihelpdesk@bah.com

Subject: [ExternalSender] comments on NRC 2015-025 1

Dear Commissioners,

Please accept this email as comments on Regulatory Guide 2191 and 2192 GALL—SLR, TIMELY FILED.

I allege that the methods and guidance in the above RGs describe a deficient pathway which allow licensees to avoid lessons learned to be adequately impleted so as to provide adequate safety to the public. Thru observing meetings and reading drafts, I come to the conclusion that the methods and suggestions therein provide means and methods to circumvent any and all lessons learned from previous history of the nuclear power fuel cycle.

I submit this comment in the hope that the Commission shall fulfill its duties as provided in the NRC Charter.

Respectfully submitted,

Marvin Lewis
2152789963
31e3 Fairfield Street
Philadelphia, PA 19136

RESPONSE:

The staff acknowledges the commenter's concern regarding protecting public safety. However, the commenter did not provide any additional information that would cause the NRC to reconsider/revise any of the recommendations or technical bases in the draft Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report or Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants (SLR-SRP). Therefore, no changes were made to the document as a result of this comment.

Furthermore, the NRC staff disagree that the methods and guidance in the subject documents allow licensees to avoid implementing lessons learned. The GALL-SLR Report contains the NRC staff's generic evaluation of plant aging management programs (AMPs) and establishes the technical basis for their adequacy. The GALL-SLR Report contains recommendations on specific areas for which existing AMPs should be augmented for subsequent license renewals. Licensees must ensure that the conditions and operating experiences at individual plants are bounded by the conditions and operating experiences evaluated in the GALL-SLR. During the NRC staff's review of a license application, the staff will ensure that operating experience is incorporated by verifying that AMPs incorporated by the licensee are consistent with the GALL-SLR, review plant-specific aging management programs, and reviewing exceptions the applicant has taken to the GALL-SLR.

The NRC does this through a robust regulatory framework that includes license requirements, inspections, oversight, performance assessment, and enforcement.

Source 040: NEI—Additional Mechanical Comments—AMPs XI.M30, XI.M32, XI.M39

Comment: 001

#42

Location of Change

SLR-SRP	Table 3.3.1-68
GALL-SLR	VII.G.AP-234
SLR-SRP	Table 3.3.1-69
GALL-SLR	VII.G.AP-132, VII.H1.AP-132, VII.H2.AP-132
SLR-SRP	Table 3.3.1-70
GALL-SLR	VII.H1.AP-105, VII.H2.AP-105
SLR-SRP	Table 3.3.1-71
GALL-SLR	VII.G.AP-136, VII.H1.AP-129, VII.H1.AP-136, VII.H2.AP-129, VII.H2.AP-136
	AMP XI.M30 AMP XI.M32

Description of Change

Revise the Aging Management Program (AMP) reference for the SLR-SRP Table 3.3.1-68, Table 3.3.1-69, Table 3.3.1-70, and Table 3.3.1-71 from AMP XI.M30, Fuel Oil Chemistry, and XI.M32, One-Time Inspection, to only reference AMP XI.M30, Fuel Oil Chemistry. Revise the GALL-SLR AMR lines associated with SLR-SRP Table 3.3.1-68, Table 3.3.1-69, Table 3.3.1-70, and Table 3.3.1-71 to delete AMP XI.M32 One-Time Inspection and only reference AMP XI.M30, Fuel Oil Chemistry

Also revise GALL-SLR AMP XI.M30, Fuel Oil Chemistry, program description second paragraph to delete the reference to one-time inspection as an acceptable verification program. In addition, revise AMP.XI.M32, One-Time Inspection program description and associated elements to delete the reference to the fuel oil environment.

Justification For Change

A one-time inspection of selected components is not required as a verification program for AMP XI.M30, Fuel Oil Chemistry. AMP XI.M30 requires each diesel fuel oil tank to be periodically cleaned and inspected on a 10 year frequency. Periodic cleaning of the tanks allows removal of water collected at the bottom of the tank to minimize the amount of time water has to collect and the length of contact time. Periodic inspections of tank internal surfaces and thickness measurements are also conducted on a 10 year frequency to ensure loss of material is not occurring. Any degradation of the tank internal surfaces is reported and is evaluated using the corrective action program.

In addition water and microbiological activity are routinely monitored. If accumulated water is found in a fuel oil storage tank, it is immediately removed. Biocides or corrosion inhibitors may also be added as a preventive measure.

Other than ground water in-leakage or inadvertent introduction, there are limited opportunities for introduction of water into fuel oil systems. Industry operating experience and one-time inspections for the initial license renewal period have confirmed the effectiveness of the Fuel Oil Chemistry Program. This operating experience has not resulted in any plant specific program for control of degradation in fuel oil systems due to water accumulation or microbiological activity.

Periodic inspections, removal of water, chemistry controls for water accumulation or microbiological activity, and operating experience support the removal of the one-time inspection requirement from SLR-SRP Table 3.3.1-68, Table 3.3.1-69, Table 3.3.1-70, and Table 3.3.1-71 and associated GALL-SLR lines.

RESPONSE:

The staff partially agreed with this comment. Changes have been incorporated as described below.

The staff has concluded that for piping and piping components exposed to the same fuel oil environment as the fuel oil storage tanks one-time inspections should not need to be conducted. The basis for this conclusion is that, as recommended by aging management program (AMP) XI.M30, “Fuel Oil Chemistry,” periodic tank inspections are conducted and the tank bottom, due to water and sediment settling in the near static conditions of the tank, would typically represent the worst environment conditions. The “Detection of Aging Effects” program element was revised to allow one-time inspections to not be conducted for: (a) components constructed of the same material as fuel oil storage tanks when the internal surfaces of the tank are not coated and (b) when a basis is provided in the application for why water pooling or separation is not possible for other material and environment combinations. Line items AP-105, AP-129, AP-132, AP-136, and AP-234 were split into two lines, one citing AMP XI.M30 and AMP XI.M32, “One-Time Inspection,” and the other citing AMP XI.M30, depending on the outcome of the conditions described in AMP XI.M30. The staff further concluded that:

- The chemistry controls related to water accumulation and microbiologically influenced corrosion (MIC) activity are mitigative preventive actions. The purpose of AMP XI.M32 is to demonstrate that mitigative actions have been effective. The staff did not agree that a change to AMP XI.M30 is warranted based on these controls.

- Operating experience has been limited to that available to date within the industry. Although commercial fuel oil systems have been in service for decades, the staff does not have access to such data, nor is it expected that it would provide the level of detail to drive conclusions associated with this comment.

- The GALL-SLR Report cites the following materials as being used in fuel oil systems: aluminum, copper alloy, stainless steel, and steel. EPRI Report 1010639, Figure 2, “Fuel Oil Tool,” states that MIC is a concern in the fuel oil environment. In addition, it states that if water pooling or separation can occur, these materials are subject to loss of material due to pitting and crevice corrosion, and general corrosion for steel materials. Although the figure also cites the potential for selective leaching of gray cast iron or uninhibited copper alloys in the presence of water, the staff has concluded that the chemistry controls are sufficient to provide reasonable assurance that selective leaching will not occur in these materials in a fuel oil environment. The staff recognizes that based on the plant configuration, it may be possible to demonstrate that water pooling or separation will not occur for portions of the system. The staff has concluded that if it can be demonstrated that no water pooling or separation will occur, then a one-time inspection is not required because there is reasonable assurance that aging effects sufficient to cause a loss of intended function will not occur.

Comment: 002

#43

Location of Change

SLR-SRP

Table 3.2.1-49
Table 3.2.1-50
Table 3.2.1-51
Table 3.3.1-97
Table 3.3.1-98
Table 3.3.1-99
Table 3.3.1-100
Table 3.3.1-101
Table 3.4.1-40
Table 3.4.1-41
Table 3.4.1-42
Table 3.4.1-43
Table 3.4.1-44
Table 3.4.1-45
Table 3.4.1-46

And associated GALL-SLR AMR lines

AMP XI.M39
AMP XI.M32

Description of Change

Revise the Aging Management Program (AMP) reference for the referenced SLR-SRP Table line items from AMP XI.M39, Lubricating Oil Analysis, and XI.M32, One-Time Inspection, to only reference AMP XI.M39, Lubricating Oil Analysis. Revise the GALL-SLR AMR lines associated with referenced SLR-SRP Table line items to delete AMP XI.M32 One-Time Inspection and only reference AMP XI.M39, Lubricating Oil Analysis.

Also revise GALL-SLR AMP XI.M39, Lubricating Oil Analysis, program description second paragraph to delete the reference to one-time inspection as an acceptable verification program. In addition, revise AMP.XI.M32, One-Time Inspection program description and associated elements to delete the reference to the lubricating oil environment.

Source 040

Justification For Change

A one-time inspection of selected components is not required as a verification program for AMP XI.M39, Lubricating Oil Analysis. Water and particulate concentration should not exceed limits based on equipment manufacturer's recommendations or industry standards. Phase-separated water in any amount is not acceptable and addressed by the corrective action program. Corrective actions may include increased monitoring, corrective maintenance, further laboratory analysis, and engineering evaluation of the system.

Other than lube oil heat exchanger failures or inadvertent introduction, there are limited opportunities for introduction of water into lubricating oil systems. Heat exchanger lube failures would be immediately repaired/corrected and lubricating oil parameters restored to acceptable levels. Industry operating experience and one-time inspections for the initial license renewal period have confirmed the effectiveness of the Lubricating Oil Analysis Program. This operating experience has not resulted in any plant-specific program for control of degradation in lubricating oil systems due to water accumulation.

Chemistry controls for water accumulation, zero tolerance for phase separated water, and operating experience support the removal of the one-time inspection requirement from the referenced SLR-SRP Table line items.

RESPONSE:

The staff did not agree with this comment. No changes were incorporated.

Although the program recommends that lubricating oil be sampled for water and particulate following periodic oil changes or on a schedule consistent with equipment manufacturer's recommendations or industry standards, there are no requirements to examine the components themselves. A one-time inspection is recommended when: (a) an aging effect is not expected to occur, but the data are insufficient to rule it out with reasonable confidence; or (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than generally expected. The use of a one-time Inspection provides assurance that after an additional period of operation, the periodic oil changes are effective in mitigating or preventing aging effects.

Source 045: NEI Comments on the Supplemental Guidance to NUREG–2191 and NUREG–2192

Comment: 001

Location of Change

Supplement A.iii.c

XI.M33 element 4

Description of Change

Selective leaching of ductile iron: Consider revising the first paragraph after the inspection and examination bullets to say:

"One-time and periodic inspections are conducted of a representative sample of each population. A population is defined as the same material and environment combination. If the initial examinations confirm selective leaching and an evaluation of sample results does not indicate a loss of structural integrity in the subsequent period of extended operation, gray cast iron and ductile iron may be treated as a single sample population. The majority of the combined sample population must be grey iron samples. Opportunistic inspections are conducted whenever components are opened, or buried or submerged surfaces are exposed."

Justification for Change

As noted in the references cited, the mechanism is similar in both forms of the iron, but is expected to be more prevalent in gray cast iron.

RESPONSE:

The staff did not agree with this comment. An alternative change was incorporated.

The staff did not agree with the proposed change for a couple of reasons. First, gray cast iron components are known to be susceptible to graphitic corrosion. As a result, a full representative population of gray cast iron components should be inspected. The proposed industry change would have allowed ductile iron inspections, up to one less than a majority of the inspections, to substitute for gray cast iron inspections in subsequent inspections (i.e., 60 years or later). Second, the industry proposed change would have allowed combination of the two populations as long as the extent of dealloying could be shown to be such that, "an evaluation of sample results does not indicate a loss of structural integrity in the subsequent period of extended operation." This is inconsistent with the Acceptance Criteria program element, which states that the criteria is not met if a surface layer can be easily removed by chipping or scraping or identified in the destructive examination. While minor dealloying may not result in a component being replaced, it is certainly grounds for continuing inspections of that material type in the next 10-year period of the subsequent period of extended operation.

However, based on the justification provided in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document (ADAMS Accession No. ML16041A090) that ductile iron is less susceptible to graphitic corrosion when compared to gray cast iron, the staff revised the Detection of Aging Effects program element to state that if the periodic inspection conducted for ductile iron in the

10-year period prior to a subsequent period of extended operation (i.e., the initial inspection) meets acceptance criteria, periodic inspections do not need to be conducted during the period of extended operation for ductile iron. In addition, based on the staff's position that an initial inspection should be conducted prior to the period of extended operation to verify that acceptance criteria are met for ductile iron, the one-time inspection requirements for ductile iron components exposed to closed-cycle cooling water (CCCW) or treated water were not revised.

Comment: 002

Location of Change

AMP XI.M33

Element 10

Operating Experience

Appendix D pg. D-6

Description of Change

Recommend not citing INPO OE sources in AMP element 10. If not deleted, the following comments apply:

In paragraph h, revise first sentence to read, "During review of INPO-compiled industry OE in August 2014, the staff noted that a licensee identified graphitic corrosion on buried ductile iron piping."

Delete the last sentence that reads "The leak was repaired using a Mueller clamp and a modification is currently being considered to improve long-term reliability."

Justification for Change

INPO information sources should not be made publically available consistent with INPO information sharing agreements.

Grammatical correction. A review does not note.

The word "currently" is probably incorrect at this date. More importantly, the sentence is unnecessary to characterize the loss of material that was observed for this item.

RESPONSE:

The staff agreed with this comment. In lieu of editing the example, the aging management program (AMP) cites the GALL-SLR and SRP-SLR Supplemental Staff Guidance document. The staff has concluded that it is not appropriate to cite Institute of Nuclear Power Operations (INPO) as a source of operating experience (OE) based on standard practices between the two organizations. As an alternative, the staff cited the GALL-SLR and SRP-SLR Supplemental Staff Guidance document instead because it provides a more detailed basis for inclusion of ductile iron than citing a singular event.

<u>Comment</u>: <u>003</u>

Location of Change

Supplement B.ii.b and
B.ii.d
3.2-1 item 54
3.3-1 item 110
3.2.2.2.9
3.2.3.2.9
3.3.2.2.9
3.3.3.2.9
XI.M7 element 1

Description of Change

Delete Table 3.2-1 item 54, Table 3.3-1 item 110. Also delete associated further evaluations, AMR lines, and references to XI.M7 BWR Stress Corrosion Cracking in SLR-SRP Table 3.2-2 and Table 3.3.2.

Change the threshold temperature for applicability of BWR SCC back to 93°C (200°F).

Justification for Change

Only two GALL rows link to these SRP rows, and both are specific to BWR components, with recommendation to use the XI.M7 BWR Stress Corrosion Cracking program. That program is based on implementation of BWRVIP-75 program which provides inspections to meet the NRC defined criteria in GL 88-01 and its technical basis NUREG–0313, Rev 2. BWRVIP was revised and approved by NRC. The weld classifications apply to piping in a reactor coolant environment. To avoid confusion with other BWR ESF and Auxiliary Systems piping in non-reactor coolant environments, delete Table 3.2-1 item 54, Table 3.3-1 item 110. Also delete the associated further evaluations, AMR lines, and references to XI.M7 BWR Stress Corrosion Cracking in SLR-SRP Table 3.2-2 and Table 3.3.2.

RESPONSE:

The staff partially agreed with this comment. The cited further evaluation sections were deleted and the temperature threshold was revised. However, the aging management review (AMR) items were not deleted.

The technical basis for deleting the further evaluation sections (note that the numbers were reassigned) is documented in the response to Comment 015-007. The temperature threshold was revised back to 93 degrees C [200 degrees F] based on the original threshold cited in GALL Report Revision 2 AMP XI.M7, “BWR Stress Corrosion Cracking.” The AMR items were not deleted because, with the exception of AP-283 (which cites AMP XI.M25, “BWR Reactor Water Cleanup System,” instead of AMP XI.M7) they are the only items that cite piping and piping components exposed to treated water >93 degrees C (>200 degrees F) in GALL-SLR Report Chapters V and VII. In that regard, they will not be confused with other items that cite the treated water environment.

Source 045

Comment: 004

Location of Change

Supplement C.ii.b. (pg. 5 last paragraph) SRP 3.2.2.2.13

SRP 3.3.2.2.13

SRP 3.4.2.2.10

Description of Change

This paragraph includes a sentence that summarizes the staff's conclusion regarding loss of material for aluminum components. The staff concluded that a one-time inspection of aluminum components prior to entry in the subsequent period of extended operation coupled with a search of plant-specific OE related to loss of material of aluminum components would provide sufficient input to determine whether periodic inspections should be conducted. This should be changed to just rely on OE review to determine whether OTI is adequate to manage loss of material.

Justification for Change

Combining OE review and OTI introduces a lot of questions regarding how to present the aging management review results in the LRA. A simpler yet effective approach is to rely only on OE to determine if the OTI is appropriate. If no adverse OE, then OTI is the AMP. If adverse OE is identified, then a periodic AMP is warranted. This is a more straightforward way to describe the evaluation. If OE points the applicant to the OTI AMP and the OTI AMP finds aging effects, then a periodic AMP is instituted in accordance with the established corrective actions of the OTI AMP.

RESPONSE:

The staff did not agree with this comment. The change proposed by the industry was not incorporated. However, to ensure that the staff's intent is clear, the further evaluation sections were revised to provide clarity on the information to be provided in the subsequent license renewal application (SLRA) and when inspections would be conducted.

In 10 CFR 54.17(c) it states, "[a]n application for a renewed license may not be submitted to the Commission earlier than 20 years before the expiration of the operating license or combined license currently in effect." Therefore, at the time of application for a subsequent license renewal, the plant would have experienced at least 40 years of operation. The staff has concluded that 40 years presents enough exposure time to the environment such that loss of material or cracking would probably have occurred. However, contrary to the recommendation by the industry, a search of plant-specific operating experience might not be solely sufficient. Loss of material or cracking may not have progressed to the point of through-wall degradation. Without through-wall degradation, leakage will not occur, and the loss of material or cracking could have gone unnoticed. Even though unnoticed, the rate of degradation could be sufficient to result in a loss of intended function prior to the end of the subsequent period of extended operation. Therefore, at a minimum, the further evaluation sections recommend a one-time inspection in conjunction with the search of plant-specific operating experience.

Based on other industry comments, the staff revised a majority of the AMR items that cite a plant-specific AMP in conjunction with a further evaluation section. As a result, the cited further evaluation sections are now linked to multiple GALL-SLR Report AMR items that singularly cite each of the recommended AMPs. For example, if the search of plant-specific OE does not reveal loss of material or cracking, the GALL-SLR Report AMR item that cites AMP XI.M32, “One-Time Inspection,” is selected during the development of the SLRA. If loss of material or cracking is noted, the applicant selects the appropriate GALL-SLR Report AMR item for the associated periodic AMP (e.g., AMP XI.M29, “Outdoor and Large Atmospheric Metallic Storage Tanks,” if the aging effect is limited to tanks).

In the GALL-SLR and SRP-SLR Supplemental Staff Guidance document, the further evaluation sections were revised to state that the applicant documents the results of the plant-specific OE review in the SLRA. In order to further clarify the staff’s intent, the further evaluation sections were revised to state that the timing of the one-time or periodic inspections is consistent with that recommended in the AMP selected by the applicant during the development of the SLRA. For example, one-time inspections would be conducted between the 50th and 60th year of operation, as recommended by the “Detection of Aging Effects” program element in AMP XI.M32. The new sentence in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document and additional sentence described above provide clarity on the information to be provided in the SLRA and when inspections would be conducted.

Given the similarity of the further evaluation sections, the above change was also incorporated into the further evaluations sections addressing loss of material due to pitting and crevice corrosion for stainless steel and nickel alloy components and cracking due to stress corrosion cracking (SCC) for stainless steel and components.

Comment: **005**

Location of Change

Supplement C.ii.b. (pg. 6 first full paragraph)

Description of Change

Change “Therefore, loss of material would not need to be age managed for the internal surfaces.” to “Therefore, loss of material would not be an aging effect requiring management for the internal surfaces.”

Justification for Change

If this sentence is retained, then it should be restructured to remove “age managed.” This term is undefined and should not be used in technical writing.

RESPONSE:

The staff partially agreed with this comment. The GALL-SLR and SRP-SLR Supplemental Staff Guidance document is not being issued within the SRP-SLR. No changes were incorporated. However, the term “age-managed” was used in three places in the SRP-SLR and GALL-SLR Report. The terms were replaced.

The staff agreed that the term “age-managed” is not defined. The staff believes that the intent of the term is understood; however, it was replaced with alternative wording in the three places where final documents will be issued because in these locations, it appeared that we were stating that components are managed, whereas aging effects are managed, not components.

Comment: 006

Location of Change

Supplement C.iii.a
3.2-1 item 4
3.2-1 item 99
3.2-1 item 106
3.2-1 item 107
3.2-1 item 113
3.3-1 item 6
3.3-1 item 217
3.3-1 item 222
3.3-1 item 228
3.3-1 item 232
3.4-1 item 3
3.4-1 item 95
3.4-1 item 98
3.4-1 item 103

GALL rows

V.B.EP-107	V.E.E-456	VII.E5.A-757	VII.H2.AP-221	VIII.D2.SP-127
V.C.EP-107	VII.C1.AP-221	VII.F1.AP-221	VII.I.A-751	VIII.E.S-446
V.D1.E-449	VII.C2.AP-221	VII.F2.AP-221	VII.I.A-761	VIII.E.SP-127
V.D1.EP-107	VII.C3.A-757	VII.F4.AP-221	VIII.A.SP-127	VIII.F.SP-127
V.D2.E-449	VII.C3.AP-221	VII.G.A-746	VIII.B1.SP-127	VIII.G.S-446
V.D2.EP-107	VII.D.AP-221	VII.G.AP-221	VIII.B2.SP-127	VIII.G.SP-127
V.E.E-442	VII.E1.AP-221	VII.H1.A-757	VIII.C.SP-127	VIII.H.S-443
V.E.E-450	VII.E4.AP-221	VII.H1.AP-221	VIII.D1.SP-127	VIII.H.S-451

Description of Change

(Loss of material and SCC for SS components): For loss of material of stainless steel in air environments, the SRP recommends either management with an ongoing program (as listed in the applicable GALL/SRP table rows) or confirmation of the absence of the aging effect by a review of site OE and a One-Time Inspection.

Consider adding ‘or AMP XI.M32, “One-Time Inspection”’ to the applicable GALL/SRP rows.

Justification for Change

Loss of material and SCC for stainless steel components: Industry does not concur that LOM and SCC of stainless steel within indoor air environments need to be managed to provide reasonable assurance that these components will continue to perform their intended functions through the subsequent PEO. However, specifying a one-time inspection of external surfaces to confirm the absence of these effects is an effective way to provide reasonable assurance that the affected components will continue to perform their intended functions.

Since the staff has determined a review of site operating experience and a One-Time Inspection are acceptable means to confirm the absence of aging effects such that periodic aging management is not needed, specifying the option of using the M32 One-Time Inspection program in the recommended AMP column in applicable GALL/SRP rows will permit assignment of note A instead of Note E in the Table 2s. This treatment appears to be appropriate, as this assignment is consistent with the SRP Further Evaluation recommendation. Confirmation of site OE review results can be specified in the SLRA text for the Further Evaluation topics.

RESPONSE:

The staff partially agreed with this comment. New GALL-SLR Report items were generated to address specific GALL-SLR Report AMPs for these further evaluation sections.

The staff agreed with the portion of the comment requesting the addition of GALL-SLR Report AMR items citing AMP XI.M32, "One-Time Inspection," for the further evaluation sections addressing loss of material and cracking of stainless steel when exposed to any air environment or condensation. In addition to adding an item for AMP XI.M32, the staff also added items for the potential periodic programs (e.g., AMP XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," AMP XI.M36, "External Surfaces Monitoring of Mechanical Components.") The further evaluation recommends that a periodic program be used if plant-specific OE identifies these aging effects for these material and environment combinations. The SRP-SLR AMR items were revised to replace citing a plant-specific AMP with a list of the potential AMPs with an accompanying "or" modifier. The staff also incorporated these changes for managing loss of material for aluminum components exposed to any air environment or condensation.

The staff did not agree with the industry's position on the susceptibility of stainless steel (SS) components to loss of material and SCC in an indoor air environment. The staff's position is documented in the GALL-SLR Report and SRP-SLR Supplemental Staff Guidance document and in the response to Comment 015-004, Part 2.

<u>Comment</u>: **<u>007</u>**

Location of Change

Supplement C.iii.a
Stainless steel
SRP 3.1.2.2.20
3.2.2.2.2
3.3.2.2.4
3.4.2.2.3
Aluminum
SRP 3.2.2.2.13
3.3.2.2.13
3.4.2.2.10

Description of Change

(Loss of material and SCC for SS components): Consider revising the third paragraph as follows:

~~*The internal surfaces of SS components do not need to be inspected if: (a) the review of plant-specific 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 either 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. Inspections focus on the most susceptible locations.

Justification for Change

The deleted text addresses actions to be taken based on the results of the One-Time Inspections, which will not be known until long after the SLRA submittal. Since identification of aging effects during One-Time Inspections drives corrective actions, including long-term AMP revision/development, specifying this action should not be necessary. If this additional action is deemed essential, it should be added to the XI.M32 program elements rather than detailed within this Further Evaluation topic.

Similar changes should be made to the corresponding FE sections for aluminum, which are worded similarly.

RESPONSE:

The staff agreed with this comment. The sentences were deleted from the further evaluation sections associated with SCC and loss of material for SS components and for loss of material of aluminum components. Comparable wording was added to AMP XI.M32, "One-Time Inspection."

The staff agreed that the cited inspections would not typically be conducted prior to submittal of the SLRA. They would occur in the 10-year period prior to the period of extended operation. The staff's intent in incorporating this wording was to eliminate the need for unnecessary inspections. If plant-specific OE does not reveal the applicable aging effect and the one-time external surface inspections do not detect the applicable aging effect, there is reasonable assurance that the aging effect is not occurring on the internal surfaces of the components. Providing comparable wording in AMP XI.M32 will accomplish the same intent.

<u>Comment: 008</u>

Location of Change

Supplement C.iii.a

Stainless steel LOM

3.1.2.2.20
3.2.2.2.2
3.3.2.2.4
3.4.2.2.3

Description of Change

See recommended editorial changes recommended in Attachment 2. Changes shown in underline or strikethrough to text in further evaluation 3.1.2.2.20. Changes similar for other further evaluations cited.

Justification for Change

Editorial changes to improve clarity and consistency with License Renewal guidance.

RESPONSE:

The staff partially agreed with this comment. With one exception, the changes were incorporated as recommended. However, some changes were subsequently revised by other changes to incorporate staff comments or concurrence review comments.

The staff has concluded that the editorial changes do not alter the intent of the further evaluation sections. However, the first sentence was not deleted, as proposed by the industry, because it provides guidance that aging effects can occur in the vicinity of insulated components or others that could potentially transport halogens to the surface of the affected component. An example is as follows. A licensee event report (LER) issued in December 2006 (ADAMS Accession No. ML063530355) cited cracking and through-wall leakage, which occurred in a SS standby liquid control tank due to the presence of leachable halogens in the grout at the base of the tank. The licensee stated that, "[i]n this case, the source of moisture was occasional condensation from above when the SLC tank lid was removed." The staff considers the removal and reinstallation of the tank's lid as a normal evolution and therefore the source of moisture is not considered event-driven.

Comment: 009

Location of Change

Supplement C.iii.b

GALL XI.M42

SRP Tables

3.2-1, 56
3.2-1, 105
3.2-1, 111
3.3-1, 223
3.3-1, 227
3.3-1, 234
3.4-1, 94
3.4-1, 97
3.4-1 item 113

GALL AMR rows

V.F.EP-3	VII.C3.A-756	VIII.E.S-445
V.D1.E-448	VII.E5.A-756	VIII.G.S-445
V.D2.E-448	VII.H1.A-756	VIII.I.S-461
V.E.E-454	VII.J.A-763	
VII.I.A-752	VIII.H.S-442	

Source 045

Description of Change

(Loss of material for aluminum alloy components):

Revise the applicable GALL/SRP rows to specify the applicable programs as recommended in the Feb 29, 2016 Industry comments, Attachment 2 (Located in PDF pg. 25 of 05-26-16_NRC_Supplemental Guidance to NUREG–2191 and NUREG–2192 Docket ID NRC-2015-0251_Attachment), comment #5, and include ‘or AMR XI.M42, “Internal Coatings/Linings for In Scope Piping, Piping Components, Heat Exchangers, and Tanks,” instead of a plant-specific program.

Enhance/revise AMP XI.M42 to address management of external surface coatings in air environments.

Justification for Change

Topic b provides an alternative to conducting inspections for loss of material by verifying coating integrity in accordance with AMP XI.M42. Unless the AMP is specified in the applicable GALL/SRP rows, its assignment would require use of note E whether or not the recommendation is present in the FE text. Therefore, without the AMP recommendation in the GALL and SRP AMR rows, this added text does not help enhance GALL consistency or review efficiency.

Additionally, the XI.M42 AMP specifies applicability to internal surfaces only. If GALL/SRP recommends its use for external surfaces, the XI.M42 AMP text should specify applicability to external surfaces as recommended in the associated further evaluations without enhancement of the AMP.

RESPONSE:

The staff agreed with this comment. GALL-SLR Report AMR items (with accompanying changes to the SRP-SLR items) were generated to include an item citing AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks,” for the items associated with further evaluation sections for managing loss of material for SS, nickel alloy, and aluminum alloy components and cracking for SS and aluminum alloy components (e.g., Sections 3.2.2.2.2 and 3.2.2.2.8). In addition, AMP XI.M42 was revised to allow its use when managing external aging effects.

The addition of the AMR items and changes to the program elements of AMP XI.M42 to provide an option to manage loss of coating integrity for external coatings are consistent with the staff’s intent stated in the further evaluation sections for managing loss of material for SS, nickel alloy, and aluminum alloy components and cracking for SS and aluminum alloy components (e.g., Sections 3.2.2.2.2 and 3.2.2.2.8).

Comment: 010

Location of Change

Supplement C.iii.c

SRP 3.2.2.2.10
SRP 3.3.2.2.10

SRP 3.4.2.2.7

Description of Change

SCC of aluminum alloy components.

Revise further evaluations 3.2.2.2.10, 3.3.2.2.10, and 3.4.2.2.7 to include evaluation of plant-specific conditions to determine if an aggressive environment exists for specific alloys and requires aging management. In addition to operating experience, specific considerations include:

- Potential for atmospheric contaminants
- Proximity of aggressive water leakage sources
- Proximity of non-metallic insulation not consistent with Regulatory Guide 1.36
- Components that operate at or above ambient temperature
- Repairs that introduce stress or change in material characteristics.

Changes should be inserted in the fifth paragraph after the second sentence. See yellow highlighted markup in Attachment 1 (Located in PDF pg. 23 of 05-26-16_NRC_Supplemental Guidance to NUREG–2191 and NUREG–2192 Docket ID NRC-2015-0251_Attachment).

Justification for Change

Indoor air is not normally expected to support cracking of aluminum unless complicated by the considerations listed in the revised FE text. For components that operate at or above ambient temperature, indoor air environments do not normally support cracking of susceptible alloys. Absence of cracking in (non-wetted) indoor air is consistent with EPRI 1010639 (Mechanical Tools), which specifies that in addition to a susceptible alloy, cracking of aluminum is applicable when the external surface is buried or exposed to a concentration of contaminants, or is exposed to an aggressive environment in outdoor locations.

Previously approved GALL aging management recommendations did not define indoor air as an aggressive environment for aluminum. Changes to aging evaluations, such as the determination that a specific material-environment combination is now susceptible to an aging effect, where it was not previously expected, should be driven by OE. Confirmation that a specific material-environment is not aggressive by review of the listed considerations via OE review should provide reasonable assurance of the applicable components' continued function.

RESPONSE:

The staff agreed with the proposed editorial changes and partially agreed with the proposed technical change related to determination of the aggressiveness of the environment. GALL-SLR Report AMR items that cite AMP XI.M32, "One-Time Inspection," were generated (with accompanying changes to the SRP-SLR items). The editorial changes are consistent with the staff's intent. The staff agreed that the local environment should be evaluated for the potential presence of halides.

The staff did not agree with the industry's statement that, "[c]hanges to aging evaluations, such as the determination that a specific material-environment combination is now susceptible to an aging effect, where it was not previously expected, should be driven by OE." The staff has concluded that a search of industry operating experience is not a solely sufficient method to confirm the insignificance of SCC. A review of industry OE is not sufficient because as documented in

Source 045

Section 7.4, “Crack Tightness” of "Outside Diameter Initiated Stress Corrosion Cracking Revised Final White Paper," October 13, 2010, (ADAMS Accession No. ML110400241), “[t]he tight nature of SCC makes it difficult to visually identify.” SCC may not have been identified unless specific inspections had been conducted. Therefore, the GALL-SLR cites the recommendation to conduct a plant-specific review of local environmental considerations coupled with one-time or periodic inspections.

The staff recognizes that for some locations of aluminum components, the plant configuration precludes the presence of halogens. For example, an aluminum tank located in a room where: (a) the component is not insulated (except for metallic insulation); (b) piping located in the vicinity is not insulated (except for metallic insulation; (c) if there is piping in the room, there are no flanges or valves in the room, or the piping segments contain treated water or gas; and (d) the ventilation system for the room does not include direct access to outdoor air potentially containing halides. However, the staff did not include the specific wording for environmental considerations as requested by the industry. Instead, the staff listed the principal considerations for environmental aggressiveness in general terms (e.g., halide-free indoor air, secondary sources of halogens such as leakage from nearby components, encapsulation in materials potentially containing halides). The staff added a review of the plant configuration (e.g., flanges within the proximity of the aluminum component) and stated that the SLRA lists the specific locations and the basis for the conclusion that there is the potential that the specific environment is not aggressive towards a specific, potentially susceptible aluminum alloy.

The staff did not include the consideration of “[p]roximity of non-metallic insulation not consistent with Regulatory Guide [RG] 1.36” because RG 1.36, “Nonmetallic Thermal Insulation for Austenitic Stainless Steel,” is applicable to stainless steel components but not necessarily aluminum components. In addition, the staff has concluded that the phrase, “or repairs that introduce stress or change in material characteristics” should not be associated with determining the aggressiveness of the environment. Repairs are not representative of environmental considerations.

Comment: **011**

Location of Change

Supplement C.iii.d

AMP XI.M29 and
AMP XI.M36

Description of Change

(Changes to AMP XI.M29 and AMP XI.M36):

No comments, industry concurs with these changes.

RESPONSE:

No response was necessary because the comment stated that, “[n]o comments, industry concurs with these changes.”

<u>Comment: 012</u>

Location of Change

Supplement C.iii.e

3.1-1 items NNN	3.2-1 item 101	3.3-1 item 6	3.3-1 item 227	3.4-1 item 94
3.2-1 item 4	3.2-1 item 102	3.3-1 item 94	3.3-1 item 228	3.4-1 item 95
3.2-1 item 7	3.2-1 item 103	3.3-1 item NNN	3.3-1 item 231	3.4-1 item 97
3.2-1 item 42	3.2-1 item 105	(multiple)	3.3-1 item 232	3.4-1 item 98
3.2-1 item 48	3.2-1 item 106	3.3-1 item 146	3.3-1 item 233	3.4-1 item 100
3.2-1 item 56	3.2-1 item 107	3.3-1 item 186	3.3-1 item 234	3.4-1 item 102
3.2-1 item NN	3.2-1 item 108	3.3-1 item 189	3.3-1 item NN	3.4-1 item 103
3.2-1 item 100	3.2-1 item 109	3.3-1 item 192	3.4-1 item 2	3.4-1 item 104
3.2-1 item 101	3.2-1 item 110	3.3-1 item 205	3.4-1 item 3	3.4-1 item 109
3.2-1 item NN	3.2-1 item 111	3.3-1 item 221	3.4-1 item 35	3.4-1 item 110
3.2-1 item 80	3.2-1 item 112	3.3-1 item 222	3.4-1 item NNN	3.4-1 item 111
3.2-1 item 99	3.2-1 item NN	3.3-1 item 223	3.4-1 item 74	3.4-1 item 112
3.2-1 item 100	3.3-1 item 4	3.3-1 item 225	3.4-1 item 93	3.4-1 item NN

Description of Change

(Changes to AMR line items): Restore (or add) specific program recommendations to GALL and SRP AMR rows for loss of material and cracking of stainless steel and aluminum alloys that recommend further evaluation.

Justification for Change

FE text makes it clear that the staff expects these aging effects to be managed by a GALL AMP, but there are no GALL/SRP AMR rows to cite with Note A. The program recommendations for multiple GALL and SRP AMR rows have been changed from a specific program recommendation to “Plant-specific aging management program.” Notable examples include Table 3.2-1 items 105 and 106, which recommend management of loss of material for <u>tanks within the scope of AMP XI.M29</u> by a plant- specific program. The associated FE text lists the GALL programs that are considered acceptable for management of the aging effects (the same programs that were removed from the AMR rows). Removal of the program recommendations from the AMR lines will require use of Note E in the Table 2s. This presentation results in less GALL consistency (fewer Notes “A”) and additional review burden, as reviewers need to evaluate the acceptability of Note E program assignments. When the SRP FE text recommends the use of specific GALL programs, then there should be GALL/SRP AMR line items that recommend those programs specifically. Inclusion of specific program recommendations in the AMR rows does not relieve applicants of providing explanation within the FE section that describes the various applications and OE reviews, so there is no reason that specific programs cannot be specified in the AMR lines when Further Evaluation is applicable.

If necessary for AMR row efficiency, consider listing multiple acceptable program recommendations within a single line item, rather than specifying a plant-specific program.

Also note that the replacement of specific program recommendations with “Plant-specific program” has resulted in multiple redundant rows, which previously recommended specific (different) programs.

Source 045

RESPONSE:

The staff agreed with this comment. The GALL-SLR Report AMR items (with accompanying changes to the SRP-SLR items) were revised to reflect each of the specific appropriate AMPs to be used in managing aging effects cited in the comment.

The staff has concluded that specifying several AMPs in GALL-SLR Report AMR items, consistent with those cited in the SRP-SLR further evaluation sections, provides material, environment, and aging effect program combinations that can be listed in LRA Table 2s as being consistent. This reduces the burden for an applicant and for the staff technical reviewer. As stated in the comment, "The technical basis for the conclusion in each of the further evaluation sections will still be addressed in the SLRA and reviewed by the staff." Therefore, this reduction in burden does not impact the breadth of technical review conducted by the staff.

Comment: **013**

Location of Change

SRP 3.2.2.9 pg. A-5
SRP 3.2.3.2.9 pg. A-10
SRP 3.3.2.2.9 pg. A-13

Description of Change

Replace "dead-legs and other piping locations with stagnant flow" with "stagnant piping locations, such as dead legs."

Justification for Change

Stagnant flow is an oxymoron. Stagnant by definition means having no flow. Literally "stagnant flow" means "flow with no flow."

RESPONSE:

The staff agreed with this comment. The cited SRP-SLR further evaluation sections had been deleted based on a different comment, so no change is required in this regard. The proposed change was incorporated into AMP XI.M7, "BWR Stress Corrosion Cracking." The staff agreed with the comment. The common use of the term "stagnant flow" is no flow. The change is consistent with the staff's intent.

Comment: **014**

Location of Change

SRP 3.2.2.2.10 pg. A-5
SRP 3.2.3.2.10
Pg. A-10

Description of Change

Change "acceptance criteria for this further evaluation is being provided for demonstrating" to "following are criteria for demonstrating".

Justification for Change

Acceptance criteria has a specific meaning and dedicated program element in NUREG‑1801. The more general term “criteria” is more appropriate for this discussion.

RESPONSE:

The staff did not agree with this comment. No change was incorporated. The staff has concluded that the use of the term “acceptance criteria” is appropriate because SRP-SLR Section 3.X.2 addresses “Acceptance Criteria” for the further evaluation sections.

Comment: 015

Location of Change

SRP 3.2.2.2.10 (top of page A-6)

Description of Change

Delete the sentence “This further evaluation item is applicable unless it is demonstrated by the applicant that one of the two necessary conditions discussed below is absent.”

Justification for Change

This discussion must be applicable because it defines the two necessary conditions that determine whether it is applicable.

RESPONSE:

The staff partially agreed with this comment. The staff did not incorporate the recommended change; however, a minor change was incorporated in order to clearly cite the applicability of SCC.

The staff revised the sentence such that SCC is the subject of the sentence, not the further evaluation. This change removes the question on whether the staff was stating that the discussion was applicable when in fact, it’s the aging effect that is applicable.

Comment: 016

Location of Change

SRP 3.2.2.2.10 pg. A-6
SRP 3.2.3.2.10
Pg. A-10

Description of Change

Simplify and clarify by changing “If the material that a component is constructed of is not susceptible to SCC then” to “If the component material is not susceptible to SCC, then.”

Source 045

Justification for Change

The phrase “the component material” is a simpler and well understood way of saying “the material that a component is constructed of”. Also, needed a comma before “then.”

RESPONSE:

The staff agreed with the change. The change was incorporated with a minor edit. The change had no impact on the staff’s intent.

Comment: **017**

Location of Change

SRP 3.2.2.2.10 pg. A-6

Description of Change

In the paragraph beginning with “Susceptible Material,” delete “providing guidance based on alloy composition will not always successfully protect against SCC in aluminum alloys. The” and replace with “the”.

Justification for Change

Deleted section is unnecessary. Providing guidance will NEVER protect against SCC. Measures consistent with such guidance must be put in place to provide such protection.

RESPONSE:

The staff partially agreed with this comment. A change was incorporated to clarify the staff’s intent. The staff agreed that “providing guidance” will not successfully prevent SCC. However, the sentence provides a transition to introducing the temper, condition, and product form as additional considerations beyond alloy composition to fully address susceptibility to SCC. The sentence was edited to remove the inference that providing guidance prevents SCC.

Comment: **018**

Location of Change

SRP 3.2.2.2.10 pg. A-6

Description of Change

Delete “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.”

Justification for Change

It appears that the material has already been evaluated and the list of material here is the result of that evaluation. It is unclear from this discussion that some type of further evaluation is necessary. The discussion of technically substantiating the basis used to make the determination is also unclear. It appears from the list provided that the staff has made the determination that these materials are susceptible. One reading of this is that the applicant is expected to technically substantiate the basis for the staff's determination.

RESPONSE:

The staff partially agreed with this comment. A change was incorporated to clarify the staff's intent. The specific materials and tempers listed in the further evaluation have been technically substantiated by the staff. The staff clarified its position by adding a sentence that clarifies that an applicant only needs to justify specific tempers that are not cited in the further evaluation section.

Comment: 019

Location of Change

SRP 3.2.2.2.10 pg. A-6
SRP 3.2.3.2.10
Pg. A-11

Description of Change

Change "If the environment that an aluminum alloy is exposed to" to "If the environment to which aluminum alloy is exposed".

Justification for Change

Editorial correction.

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended. The change had no impact on the staff's intent.

Comment: 020

Location of Change

SRP 3.2.2.2.10 pg. A-6
SRP 3.2.3.2.10
Pg. A-11

Description of Change

Change "will not occur and the aging effect is not applicable." to "is not an aging effect requiring management."

Justification for Change

Aging effect applicability is not a concept espoused in the license renewal rule. The phrase "aging effect requiring management" is more consistent with the rule.

Source 045

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended. The change had no impact on the staff's intent.

Comment: 021

Location of Change

SRP 3.2.2.2.10 pg. A-6

Description of Change

Change "atmospheric air" to "air."

Justification for Change

Atmospheric air is simply air. This change should be made throughout the GALL report and SRP.

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended and is consistent with the staff's intent.

Comment: 022

Location of Change

SRP 3.2.2.2.10 pg. A-6

Description of Change

In paragraph on "Aggressive Environment," consider deleting "generally."

Justification for Change

If "generally" is retained, the discussion should explain the conditions when the stated consideration does not apply.

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended and is consistent with the staff's intent. The term "generally" does not change the context of any of the sentences in which the term was used.

Comment: 023

Location of Change

SRP 3.2.2.2.10 pg. A-6

Description of Change

Change “such as outdoor air, raw water, waste water, and condensation” to “such as, raw water, waste water, condensation and outdoor air.”

Justification for Change

This put the order of the examples in the same order as the preceding aqueous solutions and air to better facilitate understanding of the sentence.

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended and is consistent with the staff’s intent.

Comment: 024

Location of Change

SRP 3.2.2.2.10 pg. A-6
SRP 3.2.3.2.10
Pg. A-12

Description of Change

In many locations the SRP refers to acceptable methods to manage aging effects. For example, the last paragraph on this page begins with, “GALL-SLR Report AMP XI.M29, “Outdoor and Large Atmospheric Metallic Storage Tanks,” is an acceptable method to manage cracking of aluminum due to SCC in tanks.” Consider revising to say “GALL- SLR Report AMP XI.M29, “Outdoor and Large Atmospheric Metallic Storage Tanks,” describes an acceptable program to manage cracking due to SCC of aluminum tanks.”

Justification for Change

It is clearer and more correct to say that a program is acceptable to manage aging effects rather than saying that a GALL section is an acceptable method.

Also, it is clearer to say “cracking due to SCC of aluminum tanks” rather than “cracking of aluminum due to SCC in tanks.” This change should be made throughout in places where a material is inserted between the aging effect and its causal mechanism. Cracking due to SCC is the aging effect; not cracking of aluminum due to SCC.

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended and is consistent with the staff’s intent.

Source 045

Comment: 025

Location of Change

SRP 3.2.2.2.10 pg. A-7

Description of Change

In last line of the page, change “to manage the aging effect of loss of material” to “to manage loss of material.”

Justification for Change

Loss of material is defined as an aging effect. There is no need to say “the aging effect of loss of material.” The phrase “the aging effect of” should be deleted throughout the GALL-SLR report and the SRP-SLR. Doing so will make the affected sentences shorter, clearer and more easily read and understood.

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended and is consistent with the staff’s intent.

Comment: 026

Location of Change

SRP 3.2.3.2.10 pg. A-11

Description of Change

In last sentence change “stress raiser” to “stress risers.”

Justification for Change

Stress riser is the more common term, and it should be plural because the rest of the sentence refers to pits and defects.

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended and is consistent with the staff’s intent.

Comment: 027

Location of Change

SRP 3.2.3.2.10 pg. A-12

Description of Change

First paragraph uses the text "…determining if the aging effect of cracking due to SCC is applicable and requires aging management include:…". Recommend changing to "…determining if cracking due to SCC requires management includes…".

Justification for Change

The phrase "the aging effect of" is unnecessary. Using "requires management" is more consistent with terminology of the license renewal rule than "is applicable and requires aging management." The subject of the sentence is "documentation" which is singular. Therefore, "include" should be "includes" and the colon is unnecessary extraneous punctuation.

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended and is consistent with the staff's intent.

Comment: **028**

Location of Change

SRP 3.2.3.2.10 pg. A-12

Description of Change

Second paragraph begins with "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…". This should be changed to "If it is determined that cracking due to SCC requires management, the reviewer is to evaluate the applicants proposed AMP to ensure that cracking is…".

Justification for Change

Added comma after applicable to correct grammar. The discussion should be specific to cracking due to SCC rather than evaluating the AMP to ensure that aging effects in general are managed.

RESPONSE:

The staff agreed with this change. The change was incorporated as recommended and is consistent with the staff's intent.

Comment: **029**

Location of Change

SRP 3.2.3.2.13 pg. A-12

Source 045

Description of Change

The discussion of evaluation of plant-specific OE refers to “includes the most recent ten years of operation.” Recommend changing to “includes OE from a recent 10- year period of operation.”

Justification for Change

This won’t necessarily be the most recent ten years of operation due to the time necessary to review and publish the LRA after completion of the OE review.

RESPONSE:

The staff agreed with this change. The change was incorporated in a different manner. The staff agreed that the search of plant-specific OE begins during the development of the SLRA. As a result, there could be a couple of year gap during the time it takes to develop the SLRA. The associated SRP-SLR sections were revised to credit the staff’s independent review of plant-specific OE during the audit.

Comment: 030

Location of Change

SRP 3.3.2.2.9 pg. A-13

Description of Change

The phrase “piping, piping components” should be changed to “piping and piping components.”

Justification for Change

Grammatical correction. The wording is correct in Section 3.2.2.2.9.

RESPONSE:

The staff agreed with this change. The change was incorporated as requested; SRP-SLR Section 3.3.2.2.9 has been deleted based on the staff’s review of other comments. The basis for the deletion of SRP-SLR Section 3.2.2.2.9 is documented in the staff’s response to Comment 015-007.

Comment: 031

Location of Change

Table 3.1-1 pg. B-2, 3rd and 4th lines

Description of Change

References to “air-dry internal” should be just “air-dry.” Other references to internal or external environments should also be removed.

Justification for Change

The environment is evaluated whether it is an internal or external environment. The material does not care whether it's internal or external as long as the environment is the same.

RESPONSE:

The staff agreed with this change. The term air-dry (internal) was revised to air-dry and the terms "internal" and "external" in association with environment descriptions were deleted where possible. GALL-SLR Report Chapter IX.D, "Use of Terms for Environments," was revised to associate the term "air, dry" with air downstream of the compressed air dryers. As defined, the term only applies to internal environments.

Comment: 032

Location of Change

3.2.1-69 and 3.2.1-NN Page B-5

Description of Change

Revise the GALL-SLR item column for SLR-SRP item 3.2.1-NNN on Appendix B page B-5 to specify V.E.E- NNN.

Justification for Change

On Appendix B page B-5, GALL-SLR item column for SLR-SRP item 3.2.1-NNN and SLR-SRP item 3.2.1-69 both reference the same GALL-SLR line of V.E.E-403. The new SLR-SRP line item is different than 3.2.1-69 and requires a further evaluation. SLR-SRP item 3.2.1-NNN should reference a new GALL-SRP line number of V.E.E- NNN.

RESPONSE:

The staff agreed with this change. The change was incorporated as requested. The change as cited in the comment is appropriate because citing V.E.E-403 for SRP-SLR item 3.2.1-NNN on page B-5 of the GALL-SLR and SRP-SLR Supplemental Staff Guidance document was a typographical error.

Comment: 033

Location of Change

3.3-1 item 225

Pg. B-22

Description of Change

Revise the GALL-SLR item column in SLR-SRP Table 3.3-1 item 225 to delete VII.I.A-762 and replace with VII.I.A-754.

Source 045

Justification for Change

GALL-SLR AMR line VII.I.A-762 is applicable to insulated aluminum piping/tanks and is aligned with SLR- SRP Table 3.3-1 item 233. GALL-SLR AMR line VII.I.A-754 is applicable to aluminum tanks in an outdoor air environment and is aligned to SLR-SRP item 225.

RESPONSE:

The staff agreed with this change. The change was incorporated as requested. Item A-762 is appropriately linked to 3.3-1, 233. However, item A-754 (3.3-1, 225) was replaced with A-482 (3.3-1, 186). The change as cited in the comment is appropriate because citing VII.I.A-762 in lieu of VII.I.A-754 for SRP-SLR item 3.3.1-225 in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document was a typographical error.

Comment: 034

Location of Change

3.4-1 item NNN

Pg. B-35 aluminum piping line

Description of Change

Delete “No” in the Further Evaluation Recommended column for Table 3.4-1 new item for aluminum piping, piping components, tanks exposed to raw water, waste water on page B-35 of the GALL-SLR Supplement.

Justification for Change

Further Evaluation Recommended column should specify “Yes” for SLR-SRP Section 3.4.2.2-10 for Table 3.4-1 new item for aluminum piping, piping components, tanks exposed to raw water, waste water.

RESPONSE:

The staff agreed with this change. The change was incorporated as requested. The item number is S-469 (3.4-1, 120). The change as cited in the comment is appropriate because the term “No” should have been removed because the column entry appropriately cites “Yes (SRP-SLR Section 3.4.2.2.10).” This was a typographical error.

Comment: 035

Location of Change

3.4-1 item NNN

Pg. B-35 elastomer seals managed by M36

Description of Change

Revise the Table 3.4-1 GALL-SLR item column to specify “VIII.H.SP-NNN” for elastomer seals, piping, piping components exposed to air that are managed by XI.M36 on page B-35 of the GALL-SLR Supplement.

Justification for Change

To be consistent with other Table 3.4-1 GALL-SLR line item references, the GALL-SLR item for elastomer seals, piping, piping components exposed to air that are managed by XI.M36 should be revised to read as, “VIII.H.SP-NNN” after the following corrections:

- Capitalize the “H”

- Replace the “E” with “SP” or “S”

RESPONSE:

The staff agreed with the change. The change was incorporated as requested. The item number is VIII.H.S-471 (3.4-1, 122). The change is an editorial correction of a typographical error in the GALL-SLR and SRP-SLR Supplemental Staff Guidance documents.

Comment: 036

Location of Change

3.4-1 item NN

Pg. B-35 elastomer seals managed by M38

Description of Change

Revise the Table 3.4-1 GALL-SLR item column to specify the following for elastomer seals, piping, piping components exposed to air that are managed by XI.M38 on page B-35 of the GALL-SLR Supplement.

VIII.D1.SP-NNN
VIII.D2.SP-NNN
VIII.E.SP-NNN
VIII.G.SP-NNN

Justification for Change

To be consistent with other Table 3.4-1 GALL-SLR line item references, the GALL-SLR item for elastomer seals, piping, piping components exposed to air that are managed by XI.M38 should be revised as follows:

- Replace the “V” with “VIII” for Steam and Power Conversions Systems
- Replace the “E” with “SP” or “S”
- Replace the “G1” with “G”

Source 045

RESPONSE:

The staff agreed with the change. The change was incorporated as requested. The item numbers are: VIII.D1.S-472, VIII.D2.S-472, VIII.E.S-472, VIII.G.S-472 (3.4-1,123). The change is an editorial correction of a typographical error in the GALL-SLR and SRP-SLR Supplemental Staff Guidance documents.

Comment: 037

Location of Change

Table of definitions

Pg. B-36

Description of Change

New definition of ductile iron includes the statement "Most steel has less than about 1.2 percent by weight carbon, while cast irons typically have between 2.5 to 4 percent." This should be changed to provide the carbon content of ductile iron.

Justification for Change

Since the definition is for ductile iron, the discussion should give the values for ductile iron; not cast iron.

RESPONSE:

The staff did not agree with this comment. No changes were incorporated. The term cast iron is inclusive of gray cast iron, ductile iron, malleable iron, and compacted graphite iron. The carbon content for all these variations of cast iron is approximately 2.5 to 4 percent.

Comment: 038

Location of Change

Table of definitions

Pg. B-36

Description of Change

Definition of ductile iron includes the phrase "resulting in increased mechanical properties." This should be clarified.

Justification for Change

The phrase "increased mechanical properties" is vague. I'm not sure that all mechanical properties are increased or that it is a good thing in all cases. "Improved" seems like it might be a better word choice than "increased." Also should consider specifying the properties that are increased or improved.

RESPONSE:

The staff partially agreed with this comment. The use of the term was revised to cite the specific properties that are increased. Based on a review of "Materials Science and Engineering: An Introduction," William D. Callister, Jr., 7th Edition, page 371, the staff concluded that the specific material properties that increase are strength and ductility.

Comment: 039

Location of Change

Table of definitions

Pg. B-36

Description of Change

In entry for "Steel," delete phrase at the end of the first sentence that says, "even though the rates of aging may vary."

Justification for Change

The rate of aging is 365 days per year. It does not vary.

RESPONSE:

The staff partially agreed with this comment. The use of the term was revised; however, the term "rate" was not removed. The staff noted that the sentence is associated with the aging effect loss of material. The phrase, "even though the rates of aging may vary" was replaced with "even though the rate of loss of material may vary amongst material types." This change provides clarity to the staff's intent in regard to the term "rate."

Comment: 040

Location of Change

AMP XI.M29
Detection of Aging
Effects, p. C-1

Description of Change

Revised sentence should be corrected. Revise to say, "When an aging effect requires management, periodic inspections are conducted. During each 10-year period of the subsequent period of extended operation, remove a minimum of either 25 1-square foot sections or 20 percent of the tank insulation and perform inspection of the exposed exterior surface of the tank."

Justification for Change

Revision created a run-on sentence that did not adequately describe the recommended inspection approach.

Source 045

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested.

<u>Comment: 041</u>

Location of Change

AMP XI.M29
Detection of Aging
Effects, p. C-1

Description of Change

Revise heading of third column of Table XI.M29-1 to “Aging effect requiring management.”

Justification for Change

As indicated in table of abbreviations on page xix of GALL-SLR Volume 2, the correct term is aging effect requiring management, not aging effect required aging management.

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested. The change was editorial in nature with no impact on the staff’s intent.

<u>Comment: 042</u>

Location of Change

SRP 3.3.2.2.2
3.3.1 item 3
VII.E1.A-69

Description of Change

Change this further evaluation topic to read:

“Cracking due to stress corrosion cracking (SCC) and cyclic loading could occur in stainless steel (SS) PWR nonregenerative heat exchanger components exposed to treated borated water greater than 60°C [>140°F] in the chemical and volume control system. The existing 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 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~~ <u>be confirmed by the XI.M32 One-Time Inspection program and</u> radioactivity monitoring of the shell side water<u>, and eddy current testing of tubes</u>.”

Justification for Change

The proposed change is consistent with the aging management techniques recently approved by the staff in recent LRA SERs.

RESPONSE:

The staff did not agree with this comment. The requested change was not incorporated; however, based on a review of SRP-SLR Section 3.3.2.2.2, the staff has incorporated changes.

Based on its review of many LRAs, the staff recognizes that few PWR plants have experienced cracking dues to SCC and cyclic loading in their nonregenerative heat exchanger components. In considering entry in a subsequent license renewal period, at least 40 years of plant-specific OE would have been accumulated. There is reasonable assurance that in this period of time, cracking in nonregenerative heat exchangers would be self-revealing if it is an applicable aging effect sufficient to warrant being managed. As a result, the staff revised SRP-SLR Section 3.3.2.2.2 to recommend that a search of plant-specific OE be conducted. If there is no evidence of cracking in the nonregenerative heat exchangers, cracking due to SCC or cyclic loading would be managed by AMP XI.M2, "Water Chemistry." For plants that have experienced cracking in the nonregenerative heat exchangers, Section 3.3.2.2.2 was revised to recommend that the AMP XI.M21A, "Closed Treated Water Systems," program be augmented to include temperature and radioactive monitoring of the shell side of the heat exchanger. Monitoring of these parameters was previously recommended in SRP-LR Revision 2. During its review of several LRAs, the staff noted that eddy current testing is not practical in some nonregenerative heat exchangers due to the heat exchanger's configuration. As a result Section 3.3.2.2.2 recommends periodic eddy current testing of the heat exchanger tubes where component configuration permits.

Comment: 043

Location of Change

AMP XI.M29 Title

Description of Change

No comments. Industry concurs with program name change.

RESPONSE:

No response was necessary because the comment stated that, "[n]o comments, industry concurs with these changes."

Comment: 044

Location of Change

LR-ISG-2015-01

pg. B-2, Element 2.e.iii pg. B-4, Element 3.d

Source 045

Description of Change

Add “(high pH, bicarbonate environments only)” after steel in each of the referenced sections of LR-ISG-2015-01.

Justification for Change

Clarification of the LR-ISG-2015-01 referenced sections is required to note that cracking of buried steel components occurs in high pH, bicarbonate environments.

RESPONSE:

The staff agreed with this comment. The Preventive Actions and Parameters Monitored or Inspected program elements of AMP XI.M41, “Buried and Underground Piping and Tanks,” were revised to clarify the cracking of buried steel components is only expected in a carbonate-bicarbonate environment.

During the development of LR-ISG-2015-01, “Changes to Buried and Underground Piping and Tank Recommendations,” the staff added SCC of steel components based on the potential for carbonate cracking of buried steel components that occurs in specific environments. NACE SP-01679, “Control of External Corrosion on Underground or Submerged Metallic Piping Systems,” 2013, Section 6.2.1.4.7, recommends adjusting the cathodic potential to address carbonate cracking in high pH environments. Figure 2, “SCC Range of Pipe in Carbonate/Bicarbonate Environments,” provides guidance on acceptable cathodic protection potentials depending on the piping temperature. ASM Handbook Volume 11, “Failure Analysis and Prevention,” Section 49.10.1, “SCC Environments,” states that carbonate cracking can occur in low and high pH conditions. The pH range for high-pH SCC is 8.5 to 11, and for low-pH SCC, the range is 6 to 8.5. However, for either to occur, the ground water must contain carbonates or bicarbonates. As a result, the staff is not incorporating the term “high ph” as requested by the industry. Additionally, SCC can occur in a carbonate-bicarbonate environment, so both terms were incorporated.

Comment: 045

Location of Change

3.1.1-134
IV.A1.R-450
IV.A2.R-450
IV.C1.R-450
IV.C2.R-450
IV.D1.R-450
IV.D2.R-450
3.2.1-87
V.E.E-422
3.3.1-182
VII.I.A-704
3.4.1-64
VIII.H.S-403

Description of Change

Do not remove the term “jacketed” from jacketed thermal insulation.

Alternatively, specify “Non-metallic thermal insulation.”

Justification for Change

It’s unclear what type of insulation was intended to be addressed by this change. Most insulation in nuclear plants is either jacketed, or mirror (metallic) insulation, although some blanket insulation may also be present. Industry recommends this specifying non-metallic thermal insulation for this AMR line consistent with Regulatory Guide 1.36, Non Metallic Thermal Insulation for Austenitic Stainless Steel”.

Implementation of this change would imply that mirror (metallic) insulation is susceptible to reduced thermal insulation resistance due to moisture intrusion, which does not seem to be appropriate. Mirror (metallic) insulation primarily reduces radiant heat loss by layers of metal while jacketed insulation reduces convective heat transfer. Wetting should have little effect on mirror insulation effectiveness.

RESPONSE:

The staff agreed with this comment. The change was incorporated as requested by revising the component description to non-metallic thermal insulation.

Reduced thermal insulation resistance was added to the GALL Report in LR-ISG-2012-02, “Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation.” GALL-SLR Chapter IX.E states that reduced thermal insulation resistance is a decrease in the effectiveness of thermal insulation as a result of moisture intrusion. Moisture intrusion impacts the thermal resistance of nonmetallic insulation materials (e.g., calcium silicate, fiberglass); however, it does not affect metallic insulation where the insulating medium is air. As a result, the component description was revised to nonmetallic thermal insulation.

Comment: 046

Location of Change

3.2.2.2.12
3.2.3.2.12

Description of Change

In addition to deletion of steel with stainless steel cladding, spent fuel storage racks, and sodium pentaborate, delete all references to stainless steel.

Justification for Change

The only GALL/SRP rows that link to this further evaluation topic are for nickel alloy components only. No stainless steel components link here.

Source 045

RESPONSE:

Not applicable. No changes were incorporated as a result of this comment. SRP-SLR Sections 3.2.2.2.12 and 3.2.3.2.12 were deleted in the response to Comment 015-007.

Comment: 047

Location of Change

3.2.1-17

V.D2.EP-73

Description of Change

Do not delete stainless steel from 3.2.1-17. Also do not delete EP-17 which would delete V.D2.EP-17.

Alternatively, make this change and change V.C.EP-63 and 3.2.1-18 to be applicable to "Piping and piping components."

Justification for Change

Water Chemistry and One-Time Inspection AMPs are appropriate recommendations for management of loss of material of stainless steel in treated water. This combination should not be deleted as it is the only generic piping row for this M/E/A/P in chapter V. Alternatively, change the component type for the only other similar MEAP row in chapter V.

RESPONSE:

The staff partially agreed with this comment. The staff incorporated changes in a different manner than recommended in the comment.

The staff deleted stainless steel from SRP-SLR AMR item 3.2.1-17. However, to ensure that there is an item citing stainless steel piping and piping components exposed to treated water, GALL-SLR AMR item V.D2.EP-73 was relocated to SRP-SLR AMR item 3.2.1-22. In turn, SRP-SLR AMR item 3.2.1-22 was updated to include treated water, and BWR plants were added to the applicability.

Comment: 048

Location of Change

3.2.1-18
V.C.EP-63
3.2.1-22

Description of Change

Instead of changing the program recommendation to "Plant- specific aging management program," add 'or AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components."'

Justification for Change

Industry strongly recommends against replacement of GALL program recommendations with plant-specific program when linking to a further evaluation topic in which specific GALL programs are recommended. This practice will result in reduced GALL consistency and reduced review efficiency due to the required use of Note E in the Table 2s. Instead of specifying a plant-specific program, list the options that are recommended in the Further Evaluation text. This practice will not relieve applicants of the need to describe their assignments and justifications in the further evaluation section of the SLRA.

Also see industry comments related to SRP 3.2.2.2.12.

RESPONSE:

The staff partially agreed with this comment. The staff incorporated changes in a different manner than recommended in the comment. As a result of deleting SRP-SLR Section 3.2.2.2.12, the AMR items cite AMP XI.M2, "Water Chemistry" and AMP XI.M32, "One-Time Inspection." The basis for deleting SRP-SLR Sections 3.2.2.2.12 and 3.2.3.2.12 and citing AMP XI.M2 and AMP XI.M32 is documented in the response to Comment 015-007.

Comment: 049

Location of Change

3.2.1-24

Description of Change

Do not add "fouling that leads to corrosion."

Justification for Change

This proposed change seems at odds with the previously listed change to EP-113 that deleted "fouling that leads to corrosion" and adds "flow blockage due to fouling." Applicants evaluate for aging effects, and AMPs manage aging effects. If the corrosion is a result of the flow blockage due to fouling, then aging management of flow blockage should also manage the fouling and associated corrosion. The mechanisms are only significant when they require specific AMP activities (e.g., selective leaching, FAC).

RESPONSE:

The staff agreed with this comment. The staff removed the term "fouling that leads to corrosion" from all GALL-SLR Report items.

The staff reviewed all of the GALL-SLR AMR items that cite fouling that leads to corrosion. In all cases, loss of material due to various mechanism (e.g., general, pitting, crevice) was cited as an aging effect. In addition, all of the cited AMPs (i.e., XI.M20, 27, 30, 38, 39, 42) recommend a one-time or periodic inspection. The staff concluded that there is reasonable assurance that the inspections for loss of material would detect fouling deposits and the presence of fouling deposits would be entered into the applicant's corrective action program. As a result, fouling that leads to corrosion was determined to not be necessary as a stand-alone aging effect requiring management.

Forms of Corrosion Recognition and Prevention, Volume 1, C.P. Dillon, NACE, 1982, page 20, “Crevice Corrosion and Deposit Attack,” states:

> These forms of attack occur in constricted areas where free access of the surrounding environment, whether vapor or liquid, is restricted. Crevice corrosion is the more general term, but often refers to metal-to-metal surfaces (e.g., a threaded fastener, coupling or joint: Figure 2.2), or metal-to-nonmetal interfaces under gaskets or wet insulation (the latter sometimes called “poultice” attack). Deposit attack suggests that the crevice has been formed by a discontinuous deposit of a foreign substance from the environment adhering to the metal surface. The deposit can be inert (as in sand) or electrochemically active (e.g., carbonaceous material, magnetite). As with pitting, a galvanic cell is set up as described above. The initial driving force is often an oxygen concentration cell or a metal ion cell, but continued growth is fostered by accumulation of acidic hydrolyzed salts within the crevice.

The staff has concluded that based on the above, because crevice corrosion is considered the more general term, there is no need to include a distinction for “fouling that leads to corrosion” which would be associated with the above term of “deposit attack.”

Comment: **050**

Location of Change

3.2.1-38
GALL IX

Description of Change

Consider defining “air.”

Justification for Change

Some proposed changes to GALL rows have combined different air environments into “air.” GALL IX lists and defines 10 different air environments, but does not define “Air” by itself. If/when the definitions are updated, consider the industry input previously provided for air/gas environment names and definitions.

RESPONSE:

The staff agreed with this comment. GALL-SLR Report Chapter IX.D was revised to include the term “air.” The basis for inclusion of the term “air” is included in the “Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192.”

<u>Comment</u>: <u>051</u>

Location of Change

3.2.1-54

Description of Change

Do not eliminate the further evaluation from this AMR line.

Justification for Change

This proposed change conflicts with Section B.ii.a of the supplement. Note that B.ii.a has a typo, in that 3.3.1-54 is referenced, but does not address the topic, and is not linked to V.D2.E-37. SRP 3.2.1-54 appears to be the row being addressed.

RESPONSE:

The staff partially agreed with this comment. The further evaluation associated with SRP-SLR item 3.2-1, 054 was deleted; however, the editorial error in the items was corrected.

GALL-SLR Report AMR item V.D2.E-37 and the corresponding SRP-SLR item 3.2-1, 054, were revised to cite AMP XI.M2 and AMP XI.M7 and no further evaluation. The basis for these changes is documented in the response to Comment 015-007.

<u>Comment</u>: <u>052</u>

Location of Change

3.2.1-68

Description of Change

The change to add groundwater is not necessary.

Delete stainless steel from the proposed change description.

Justification for Change

Definition of soil in GALL IX.D includes groundwater. Also, based on the two GALL-SLR lines (V.D1.E-402 and V.D2.E-402) referenced by 3.2.1-68, the only applicable material identified is steel.

RESPONSE:

The staff agreed with this comment. The term “groundwater” was deleted. Stainless steel was deleted from SRP-SLR item 3.2-1, 068.

The use of the term “buried” in GALL-SLR Chapter IX.D was revised to include the statement, “[w]hen the soil environment is cited, the term includes exposure to groundwater.” With the inclusion of this statement, the GALL-SLR AMR item entries have been simplified as suggested in the comment.

The staff also removed the term “underground” from the term “buried and underground” and created a new entry for the underground environment. As is the case for the “buried” term, the addition of, “[w]hen the underground environment is cited, the term includes exposure to air-outdoor, air-indoor uncontrolled, air, raw water, ground water, and condensation,” allows for simplification of the AMR item entries.

Managing loss of material for stainless steel tanks within the scope of AMP XI.M29, “Outdoor and Large Atmospheric Metallic Storage Tanks,” exposed to air or condensation was relocated to a new GALL-SLR Report item, E-449 (3.2-1, 106). Subsequent to issuance of the GALL-SLR Report, the staff noted that there is no corresponding item in Chapter V for stainless steel tanks exposed to soil or concrete. However, Chapter VII (A-758, 3.3-1, 229) and Chapter VIII (S-447, 3.4-1, 099) include items addressing this material-environment-aging effect-program combination.

Comment: 053

Location of Change

3.2.1-83

Description of Change

Do not delete. Recommend adding “Air” to GALL Chapter IX definitions.

Justification for Change

3.2.1-83 is not overtaken by changes to 3.2.1-38. SRP 3.2.1-83 row applies only to BWRs, and is linked only from V.B.EP-59, which is within the Standby Gas Treatment System table.
PWR applicants will not use V.B.EP-59/3.2.1-38, they need V.E.E-426/3.2.1-83.

RESPONSE:

The staff agreed with this comment. The staff incorporated changes in a different manner than recommended in the comment.

Based on the comment, the staff recognizes that SRP-SLR AMR item 3.2.1-038 only applied to BWR plants. In order to eliminate unnecessarily duplicative AMR items, the staff retained the deletion of item 3.2.1-083. Item 3.2.1-038 was revised to cite PWR and BWR plants and the GALL-SLR Report item was revised to align to Table E, V.E.E-426. The environment for V.E.E-426 was revised to air. Inclusion of the term “air” is addressed in the staff’s response to Comment 045-050.

Comment: 054

Location of Change

3.2.1-84

Description of Change

Do not delete. Recommend adding “Air” to GALL Chapter IX definitions.

Justification for Change

3.2.1-84 is not overtaken by changes to 3.2.1-43. SRP 3.2.1-84 row applies only to BWRs, and is linked only V.BEP-58 (Standby Gas Treatment System). PWR applicants will not use V.B.EP-58/3.2.1-43. Additionally, the condensation environment is specified in 3.2.1-84 but not addressed in 3.2.1-43.

RESPONSE:

The staff agreed with this comment. The staff incorporated changes in a different manner than recommended in the comment.

Based on the comment, the staff recognizes that SRP-SLR AMR item 3.2.1-43 only applied to BWR plants. In order to eliminate unnecessarily duplicative AMR items, the staff retained the deletion of item 3.2.1-84. Item 3.2-1,043 was revised to cite PWR and BWR plants. Four new items, E-427, were added to item 3.2.1-43, citing Tables A, B, D1, and D2. The environment for V.E.E-426 was revised to air. Air and condensation were cited as applicable environments. Inclusion of the term “air” is addressed in the staff’s response to Comment 045-050.

<u>Comment</u>: <u>055</u>

Location of Change

3.2.1-89

E-433

Description of Change

Even though steel is deleted from E-433/3.2.1-89, the line is not consistent with other GALL-SLR changes and further evaluations. No changes are recommended to E-46/3.2.1-39.

Justification for Change

Recommend revising stainless steel, nickel alloy, copper alloy and aluminum in E-433/3.2.1-89 to be consistent with other GALL-SLR changes from external air environments.

RESPONSE:

The staff agreed with this comment. The staff incorporated changes in a different manner than recommended in the comment.

The staff deleted SRP-SLR AMR item 3.2.1-89 (E-433) because the group of materials included those for which a further evaluation of aging effects is appropriate (i.e., stainless steel, nickel alloy, aluminum) and those where further evaluation is not necessary (i.e., steel, copper alloy). The following GALL-SLR Report items address piping and piping components exposed to air or condensation for which loss of material is managed by AMP XI.M36, “External Surfaces Monitoring of Mechanical Components”:

- Stainless steel, nickel alloy: EP-107, 3.2-1, 004
- Aluminum: EP-114, 3.2-1, 042

- Steel: E-44, 3.2-1, 040
- Copper: EP-10, 3.2-1, 057

Comment: 056

Location of Change

3.2.1-95
3.3.1-206
3.4.1-88

Description of Change

Copper alloys with >8% aluminum in borated water leakage.

Recommend deleting these SLR-SRP Table 1 items and associated AMPs.

Justification for Change

The rational that was used to justify no aging effects and no aging management requirements for aluminum in a borated water leakage environment would apply to copper alloys with any aluminum content. Therefore copper alloys with any aluminum content could be evaluated as copper alloys and apply existing SLR-SRP lines such as Table 3.2-1 item 58.

RESPONSE:

The staff agreed with this comment. The staff incorporated changes in a different manner than recommended in the comment.

The staff has concluded that copper alloys with any aluminum content are not susceptible to loss of material when exposed to an air with borated water leakage environment. The basis for this conclusion is documented in the basis for the GALL-SLR Report AMR items citing copper alloy (>8% Al) exposed to air with borated water leakage (i.e., EP-12, AP-11, SP-104). The staff deleted the SRP-SLR items cited in the comment. The use of the term “copper alloy (>15% Zn or >8% Al)” was revised to state that copper aluminum bronze alloys are not susceptible to loss of material due to boric acid corrosion.

Comment: 057

Location of Change

3.3.1-10

Description of Change

Do not add another environment of “any environment for cyclic loading” with applicability to only one aging effect. Instead, changing the environment to a single environment of “air.”

Justification for Change

No other GALL/SRP rows list specific M/E/A (for cracking) and then include “any environment” for a different aging effect. Cracking of bolting is addressed for most material/environment combinations. If the proposed revision is expected to fill a gap, consider making it a separate row. Implementation of specific environments for some aging effects and "any" environment for others within a single GALL/SRP row is difficult to implement using an aging management database.

RESPONSE:

The staff agreed with this comment. The staff incorporated changes in a different manner than recommended in the comment.

In GALL Report Revision 2, this AMR item cited air with steam or water leakage as the applicable environment. The staff concluded that citing an air environment maintains the staff intent from GALL Report Revision 2 while clarifying that cracking due to cyclic loading could occur in environments other than those with steam or water leakage (e.g., air-indoor uncontrolled). As documented in EPRI Report 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools," Revision 4 Section 3.2, "Cracking of Bolting Materials," SCC of high-strength bolting can occur due to the introduction of "contaminant species, such as sulfides or chlorides…" This section also states that "inadvertent exposure may result from gasket leaks." As documented in the GALL-SLR and SRP-SLR Supplemental Staff Guidance documents, leakage from mechanical connections such as bolted flanges and valve packing can result in the transport of contaminants to the surface of susceptible components. In reviewing this item, the staff recognized that the soil and underground environment can also introduce contaminant species. As a result, all three environments were cited because all of them are appropriate for both of the cited aging mechanisms (i.e., SCC, cracking due to cyclic loading).

Comment: **058**

Location of Change

3.3.1-12

Description of Change

Recommend changing the A-03 environment to air-indoor uncontrolled or air-outdoor, for consistency with 3.3.1-12.

Justification for Change

Consistency with linked GALL rows.

Changing the A-03 environment will make aging evaluation matches easier for many applicants that do not define an environment of air with steam or water leakage (leakage is considered an event, not an environment).

RESPONSE:

The staff partially agreed with this comment. The environment was changed to air–indoor uncontrolled, air–outdoor, condensation. The basis for the change in environment is document in the staff's response to Comment 015-038.

Source 045

Comment: 059

Location of Change

3.3.1-58

Description of Change

In addition to adding “condensation” to this AMR row, consider also adding “air-outdoor” to address CO_2 piping from storage tanks that may be outside.

Also, consider previous industry comments regarding air environments (delete air-moist).

Justification for Change

Provide for aging management of fire protection CO_2/Halon systems in air-outdoor environments.

RESPONSE:

The staff agreed with this comment. The environment was changed to air–indoor uncontrolled, air–outdoor, condensation. The environment was changed to air–indoor uncontrolled, air–outdoor, condensation because these environments are consistent with the component description, material and aging effect cited in the AMR item. This change meets the intent of the comment in that the environments encompass all those to which halon/carbon dioxide fire suppression piping would be exposed.

The deletion of the term “moist air” is addressed in the staff’s response to Comment 015-006, Part 4.

Comment: 060

Location of Change

3.3.1-72
A-547
A-724

Description of Change

If Ductile iron is being added to A-02, AP-31, A-50 and A- 51, consider also adding it to A-547 and A-724, which also link to 3.3.1-72.

Justification for Change

Consistent treatment for GALL rows that link to 3.3.1-72.

RESPONSE:

The staff agreed with this comment. The changes were incorporated as requested. As documented in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document, the staff has concluded that ductile iron components are susceptible to loss of material due to selective leaching in a waste water or soil environment. GALL-SLR AMR items A-547 and A-724 cite these environments and loss of material due to selective leaching.

Comment: 061

Location of Change

3.3.1-89

Description of Change

The proposed change includes the addition of “steel” and “moist air (internal” to AP-143 and deletion of VII.G.A-23. However, these changes appear to already be implemented in the draft NUREG–2191.

Justification for Change

Many of the changes appear to already be implemented. Recommend deleting “for fire water system components” from the AMP column. See also comment on 3.3.1-220.

RESPONSE:

The staff agreed with this comment. The changes were incorporated as requested.

The staff reviewed the GALL-SLR and SRP-SLR Supplemental Staff Guidance documents against the SRP-SLR issued for public comment and noted that the changes cited in the comment were already incorporated as stated. The term “for fire water system components” was deleted in the GALL-SLR and SRP-SLR Supplemental Staff Guidance document because the item only cites Chapter VII.G., “Fire Protection.”

Comment: 062

Location of Change

3.3.1-95

Description of Change

Proposed change includes deletion of AP-278 from linked GALL rows and creation of a new Table 1 entry for its MEAP “absent citing aluminum as an applicable material.”

Either leave AP-278 link as-is or delete “aluminum” from 3.3.1-95 applicability if a new Table 1 entry is created to address aluminum and link to AP-278.

Justification for Change

3.3.1-95 currently includes aluminum, and the only linked GALL row that includes aluminum is AP-278.

RESPONSE:

The staff agreed with this comment. The changes are described as follows.

Source 045

GALL-SLR report items, and corresponding SRP-SLR items were revised as follows. The basis for each of these changes or addition of new items are documented in the basis for each item.

- Stainless steel, nickel alloy, and copper alloy piping, piping components, heat exchanger components and tanks exposed to waste water were retained in item 3.3-1, 095, as issued for public comment, (revised items AP-272, AP-275, AP-276, AP-278, and AP-279).

- Stainless steel and nickel alloy piping, piping components, heat exchanger components and tanks exposed to condensation are addressed in new or revised items AP-221, A-751, and A-770.

- Aluminum piping, piping components, heat exchanger components and tanks exposed to condensation are addressed in new items A-763 and A-771.

- Copper alloy piping and piping components exposed to condensation are addressed in revised item AP-144, which states that there are no aging affects requiring management. Reduction of heat transfer due to fouling of copper alloy heat exchanger tubes is addressed separately in item A-565. Based on the staff's review of LRAs, copper alloy tanks were not addressed. Subsequent to the issuance of the GALL-SLR Report, the staff noted that there are no comparable items for copper alloy heat exchanger components exposed to condensation. The staff's intent is that citing AP-144 would be acceptable for heat exchanger components and tanks because, the basis as cited in the change to AP-144 is equally applicable to piping, piping components, heat exchanger components and tanks.

- Steel piping, piping components, heat exchanger components and tanks exposed to waste water are addressed in the revised AP-281.

- Steel piping, piping components, heat exchanger components and tanks exposed to condensation are addressed in the revised AP-281.

Comment: 063

Location of Change

3.3.1-96.4

Description of Change

Do not add air (external) as an environment to 96.4 or the new row.

Justification for Change

Generic "air" environment does not lead to loss of material for stainless steel, aluminum and copper alloys. In the absence of a link to the further evaluation that provides for confirmation of the absence of loss of material, air should not be listed as an environment expected to result in loss of material for the stainless steel, copper alloy and aluminum. For example, ventilation heating coils made of these materials would not be expected to be wetted, not susceptible to loss of material.

RESPONSE:

The staff agreed with this comment. The changes are described as follows.

The environment of air was removed from SRP-SLR AMR item 3.3.1-96.4 (cited as 3.3-1, 96b in the final version of SRP-SLR). The items citing 3.3-1, 96b (A-417) cite condensation as the only environment. As stated in the GALL-SLR and SRP-SLR Supplemental Staff Guidance documents (ADAMS Accession No. ML16041A090), loss of material is applicable for stainless steel and aluminum components exposed to an air environment. As a result, stainless steel and aluminum heat exchanger components exposed to air are addressed in new GALL-SLR Report items A-770 and A-771, respectively. It should be noted that nickel alloy was added to A-770. The staff's basis for these changes are documented in the basis for each individual AMR item. Based on subsequent research by the staff, copper alloy was deleted from 3.3-1, 96b, because it has been determined that there are no aging effects requiring management for copper alloy components exposed to air or condensation (see the basis for the revised item AP-144).

Comment: 064

Location of Change

3.3.1-97

Description of Change

Do not delete VII.G.AP-127 from this line item, or provide an alternate row for steel components in diesel fire pump lube oil system.

Justification for Change

The proposed change separates the Reactor Coolant Pump oil collection system components from those in normal lube oil environment and creates a new row for them. VII.G.AP-127 corresponds to normal lube oil components, and is the only such row in VII.G (fire protection) and would likely be used to represent diesel fire pump lube oil subsystem components.

RESPONSE:

The staff agreed with this comment. GALL-SLR Report AMR item VII.G.AP-127 will not be deleted. The staff concluded that item VII.G.AP-127 cites the appropriate material, environment, and aging effect programs to manage loss of material for applicable components in the fire water system (e.g., diesel fire pump lubricating oil system).

Comment: 065

Location of Change

3.3.1-125

Description of Change

Proposed change is to add nickel alloy to GALL items associated with "piping, piping components, and heat exchangers." Suggest deleting "heat exchangers" from applicability.

Source 045

Justification for Change

There are no GALL rows that cite heat exchangers that link to 3.3.1-125.

RESPONSE:

The staff agreed with this comment. SPR-SLR AMR item 3.3.1-125 will not cite heat exchanger components. The staff concluded that heat exchanger components should not be cited in SPR-SLR AMR item 3.3.1-125. Managing loss of material for nickel alloy heat exchangers exposed to treated water or treated borated water is addressed in GALL-SLR Report AMR item E-428. If an applicant has a nickel alloy heat exchanger in its auxiliary systems, item E-428 could be cited.

Comment: 066

Location of Change

3.3.1-215
3.3.1-218

Description of Change

Do not delete “condensation.”

If “Air-indoor” is to be used as a listed environment, consider including it in the definitions in GALL IX.D

Justification for Change

Some applicants may use “condensation” to describe the internal air space of the tanks.

Environment names used in SRP and GALL should be defined.

RESPONSE:

The staff agreed with this comment. Condensation was not deleted. Air was used as an environment. The use of the term “air” has been incorporated into GALL-SLR Report Chapter IX.D.

The terms “air-indoor uncontrolled” and “air-outdoor” were replaced with a more general term, “air.” The term “air” is appropriate because the cited AMPs recommend internal and external inspections regardless of the type of air to which the tank is exposed. The basis for inclusion of the term “air” is included in the “Technical Bases for Changes in the Subsequent License Renewal Guidance Documents NUREG–2191 and NUREG–2192.” The items will cite condensation as an environment because condensation could occur on the inside or outside surfaces of the tank. The term “moist air” was deleted throughout the GALL-SLR Report in response to Comment 015-006, part 4.

Comment: 067

Location of Change

3.3.1-220

Description of Change

Proposed change (to add copper alloy to VII.H2.A-23) is currently implemented in SLR GALL.

Justification for Change

No change needed to establish the desired presentation. See also comment for 3.3.1-89.

RESPONSE:

The staff agreed with this comment. No change was required as a result of the comment; however, item VII.H2.A-23 was subsequently deleted.

The staff reviewed the GALL-SLR and SRP-SLR Supplemental Staff Guidance documents against the SRP-SLR issued for public comment and noted that the change cited in the comment were already incorporated as stated. However, item VII.H2.A-23 was deleted because it was enveloped by changes to A-26.

Comment: 068

Location of Change

3.4.1-13
VIII.B1.SP-74
VIII.D1.SP-74
VIII.F.SP-74
VIII.G.SP-74

Description of Change

Do not add “BWR.”

Justification for Change

Only four GALL rows link to this item, and all are in PWR-specific system sections VIII.B1 (Main Steam–PWR), VIII.D1 (Feedwater–PWR), VIII.F (Steam Generator Blowdown–PWR) and VIII.G (Aux Feedwater–PWR). BWRs will not be citing these rows.

RESPONSE:

The staff partially agreed with this comment. SLR-SRP item 3.4-1, 013 was deleted and all associated GALL-SLR items were relocated to 3.4-1, 014. Item 3.4-1, 014 cites both BWR and PWR plants. Item 3.4-1, 013 was deleted because item 3.4-1, 014 covered the same material, environment, and aging effect program combination.

Source 045

<u>Comment</u>: <u>069</u>

Location of Change

3.4.1-14
VIII.A.SP-71
VIII.B1.SP-71
VIII.B2.SP-160
VIII.B2.SP-73
VIII.C.SP-71
VIII.C.SP-73
VIII.D2.SP-73
VIII.E.SP-73
VIII.E.SP-78
VIII.F.SP-78

Description of Change

Do not delete “piping and piping components,” “BWR” and “treated water.”

Justification for Change

The GALL rows listed at left all link to this SRP item. Eight rows are for piping components. Eight rows are applicable to BWRs. Six of the rows are for treated water.

RESPONSE:

The staff agreed with this comment. The changes were incorporated as requested. The staff concluded that for SRP-SLR AMR item 3.4.1-14 and associated GALL-SLR Report items, loss of material for the cited steel components exposed to steam or treated water is appropriately managed by AMP XI.M2, “Water Chemistry,” and AMP XI.M32, “One-Time Inspection,” consistent with other GALL-SLR Report items (e.g., SP-77).

<u>Comment</u>: <u>070</u>

Location of Change

3.4.1-18

Description of Change

Do not move VIII.E.SP-100 and VIII.G.SP-100 to 3.4.1-17, OR, implement the proposed change and change 3.4.1-17 to BWR/PWR

Justification for Change

SRP item 3.4.1-17 links to only one GALL row: VIII.F.SP-100, in the Steam Generator Blowdown section. This item is applicable to PWRs only. VIII E.SP-100 is applicable to BWRs and PWRs.

It’s not clear that implementing the proposed change provides any advantage or simplification, and would require also require revision of the applicability of 3.4.1-17 to include BWRs. Suggest no change for this item.

RESPONSE:

The staff partially agreed with this comment. SRP-SLR item 3.4-1, 017 was deleted and the associated item was relocated to item 3.4-1, 018. Item 3.4-1, 017 was deleted because item 3.4-1, 018 covered the same material, environment, and aging effect program combination.

Comment: 071

Location of Change

3.4.1-33

Description of Change

Do not delete soil and groundwater and delete S-440.

Justification for Change

S-440 is for copper alloy >15% Zn in soil or groundwater. This item is not enveloped by 3.4.1-32, as that item only addresses gray cast iron.

RESPONSE:

The staff partially agreed with this comment. Item S-440 was deleted. Groundwater was deleted, but soil was retained as an environment. Item S-440 was deleted because S-439 addresses the same material, environment, and aging effect program combination. Groundwater was deleted because the revised term “buried” states that when the soil environment is cited, the term includes exposure to groundwater.

Comment: 072

Location of Change

3.3.1-72

(see page E-13)

Description of Change

This change is unnecessary because copper alloy lines currently exist in 3.3.1-72.

Justification for Change

This change is not necessary because the copper alloy lines A-47 and A-66 (>15%Zn or .8%Al) currently exist in 3.3.1- 72. Due to line 3.3.1-72 being identified on page E-13 for the GALL-SLR Supplement, the proposed changes require revision if they were intended for Table 3.4.1.

RESPONSE:

The staff agreed with this comment. The changes as described in the comment cited in the GALL-SLR and SRP-SLR Supplemental Staff Guidance documents were not incorporated.

Source 045

The changes cited for SRP-SLR AMR item 3.3.1-72 were inadvertently located in GALL-SLR and SRP-SLR Supplemental Staff Guidance document on page E-13. The changes should have been included with the other changes to item 3.3.1-72 on page E-9. In retrospect, the staff concludes that the material-environment-aging effect-program combination addressed in the comment is enveloped by SRP-SLR AMR item 3.3.1-214. The changes to item 3.3.1-72 shown on page E-13 were not incorporated into the final issuance of the documents.

Comment: 073

Location of Change

3.5.1-79 and the Generic soil, groundwater change

Description of Change

Consider that environment names in GALL/SRP should be consistent with the definitions in GALL--SLR IX.D. Recommend deleting groundwater in all soil/groundwater environment combinations.

Justification for Change

There are 47 rows in GALL that use the defined terminology “Groundwater /soil,” and 33 that use “Soil, groundwater.” Recommend using an environment of “soil” because the GALL-SLR Chapter IX.D definition for soil includes consideration of groundwater.

RESPONSE:

The staff partially agreed with this comment and associated changes to the GALL-SLR Report have been made. The staff has concluded that incorporating this change improvise improves the efficiency of referencing the GALL-SLR Report AMR item tables with no reduction in clarity of the staff’s intent to consider ground water when a component is located in a soil environment. The staff revised the GALL-SLR Report Chapter IX.D use of the term “buried” to include, “[w]hen the soil environment is cited, the term includes exposure to groundwater.” This allows the GALL-SLR Report AMR item tables to singularly cite soil. As a result, in the context of the term "soil" in relation to buried components, the term "ground water" was deleted. The term “groundwater/soil” was not revised as used in the context of GALL-SLR Chapters II and III AMR items. The term has unique characteristics associated with structural components. Subsequent to the issuance of the GALL-SLR Report, it was noted that item TP-219 (3.5-1, 079) was not revised to cite “groundwater/soil.” The staff’s intent is that there is no difference between “soil, groundwater” and “groundwater/soil.” This allows the GALL-SLR Report AMR item tables to singularly cite soil.

Comment: 074

Location of Change

Piping element

Description of Change

To address the “Piping element” definition change, also consider the following:

a. Delete "piping elements," from the "Piping, piping components, piping elements, and tanks" definition in IX.B. Note that the inclusion of sight glasses should not be changed, as there may be polymer sight glasses that are not addressed by "piping elements."

b. Delete "piping elements" from the definition of reactor coolant pressure boundary components.

c. Delete "and piping elements," from Lubricating oil definition in IX.D, or add glass to the materials being discussed.

d. Delete "and piping elements" from definition of "reduction in impact strength" in IX.E.

e. Delete "and piping elements" from the definition of Cladding degradation in IX.F.

f. Delete "and piping elements," from the first sentence of XI.M38 program description, and from the scope of program element.

g. Delete "and piping elements" from the XI.M39 Scope of program.

h. Delete "and piping elements" from the Table XI-01 Description of program for the XI.M12 program.

i. Delete "and piping elements" from SRP Table 3.1.1-106.

Justification for Change

a. The "Piping, piping components and piping elements" component group will no longer appear, and piping elements is defined separately.

b. It is unlikely that any reactor coolant pressure boundary components could be made of glass.

c. Piping elements are made of glass, per new definition.

d. Glass is not susceptible to reduction in impact strength.

e. Definition is applicable to stainless steel cladding, not to glass.

f. Since glass has no aging effects, it will not be managed by the XI.M38 program.

g. Since glass has no aging effects, it will not be managed by the XI.M39 program.

h. Since glass has no aging effects, it will not be managed by the XI.M12 program.

i. Line item addresses nickel alloy components, not glass.

RESPONSE:

The staff agreed with this comment. The changes were incorporated as requested. The staff conducted its own independent search and confirmed that the term "piping element" has been deleted except in those locations where it was cited in association with components constructed of glass material.

<u>Comment: 075</u>

Location of Change

IV.E

Description of Change

Proposed change to “Hardening and loss of strength” definition may have been intended for the “Reduction in impact strength” definition instead.

Justification for Change

The proposed change deletes the term “piping element,” but that term is not present in the “Hardening and loss of strength” definition, but it is present in the “Reduction in impact strength” definition.

RESPONSE:

The staff agreed with this comment. The changes were incorporated as requested. The change as shown on page E-16 of the GALL-SLR and SRP-SLR Supplemental Staff Guidance document should have cited the use of the term for reduction in impact strength.

<u>Comment: 076</u>

Location of Change

Table XI.M27-1

Description of Change

Revise the proposed to note to say “Where NFPA 25 or this table cite annual testing or inspections, testing and inspections can be conducted on a refueling outage interval if plant-specific OE has shown no loss of intended function of the in-scope SSC due to age-related degradation.

Justification for Change

Loss of function due to other reasons should not impact frequency of inspections for age-related degradation.

RESPONSE:

The staff partially agreed with this comment. The staff incorporated the change, but with different wording.

Although the term “age-related degradation” is cited in several AMPs, it is not defined in the GALL-SLR Report or SRP-SLR. However, the staff agreed with the intent of this comment. There could be many causes for a fire water system component to not meet its intended function.

Some of these are not related to aging (e.g., damage to a sprinkler, bent valve stems that lead to restricted flow). Rather than using the term “age-related degradation,” the staff used existing language to communicate the same intent as the industry proposal, “due to aging effects being managed for the specific component (e.g., loss of material, flow blockage due to fouling).”

Comment: 077

Location of Change

XI.M27 acceptance criteria bullet (c)

Description of Change

Delete or reword such that applicants need not confirm that “no” loose fouling products remain. If not deleted, suggest “If loose fouling products have been identified, the affected piping has been cleaned or flushed.”

Justification for Change

Acceptance criteria (c) should not be needed, since (a) requires that the system is able to maintain required pressure and flow rates. Applicants may be concerned with confirming that “no” fouling remains following cleaning or flushing. This standard may be impossible to meet. If system is able to deliver required flow and pressure, any remaining loose material does not affect function.

RESPONSE:

The staff partially agreed with this comment. The staff incorporated changes that addresses the concern that “no” fouling products are present.

The staff recognizes that it is unreasonable to expect that every possible loose fouling product has been removed from a system. The staff has concluded that the proposed acceptance criterion is appropriate, “no loose fouling products exists in the sprinkler systems that could cause flow blockage in the sprinklers.” Loose fouling products that “could cause flow blockage in the sprinklers” could likely result in the loss of intended function of a sprinkler. The purpose of an acceptance criterion is to determine whether sufficient degradation has occurred such that corrective actions should be taken. In many of the AMPs, the “corrective actions” program element simply cites the applicant’s Appendix B program. In this case, the staff concluded that adding a specific corrective action would be appropriate to ensure that the AMP recommends the correct actions and it is clear that the staff’s intent is not zero fouling products. The new corrective action states, “When loose fouling products that could cause flow blockage in the sprinklers is detected, a flush is conducted in accordance with the guidance in NFPA 25 Appendix D.5, “Flushing Procedures.”

Source 045

Comment: **078**

Location of Change

XI.M42 Detection of aging effects

Description of Change

The proposed change does not affect the meaning of the sentence. Revise to "If a baseline has not been previously established, ~~between the 50th and 60th year of operation,~~ baseline coating/lining inspections occur in the 10-year period prior to the subsequent period of extended operation. Subsequent inspections…"

Justification for Change

Some later SLR applicants will have implemented the XI.M42 program for the initial PEO. These applicants will have already established a baseline prior to their 40th year of operation. Establishment of a new baseline should not be necessary for continued implementation of the program.

RESPONSE:

The staff agreed with this comment. The staff incorporated the change, but with different wording.

The basis for accepting this change is that the Detection of Aging Effects program element of AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," defines the extent of a baseline inspection (e.g., all accessible internal surfaces of tanks). If a baseline inspection had been conducted outside of the 50^{th} – 60^{th} year period, the results would be used to conduct the follow-on inspections. The longest duration between inspections, as recommended in Table XI.M42-1, Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers," is 6 years. As a result, any inspections conducted outside of the 50^{th} – 60^{th} year period would have to be repeated in the first year of the subsequent period of extended operation unless periodic inspections had been conducted since the baseline inspections. If a baseline inspection has not been conducted, the AMP clearly recommends that it occur in the 10-year period prior to the subsequent period of extended operation.

Comment: **079**

Location of Change

M27 element 4b fouling (topics iii and iv in Section G)

Description of Change

See comment for AMP XI.M27 acceptance criteria bullet (c) regarding a minor wording change.

Justification for Change

As noted in the comment for AMP XI.M27 acceptance criteria bullet (c), the industry concurs that efforts should be made to remove loose debris, but is concerned with the wording that implies that “no” such fouling products remain. Such a standard may be impossible to meet.

RESPONSE:

See the response to Comment 045-077.

Comment: 080

Location of Change

M32 inspection for “Long-term loss of material” (Section G topic v)

Description of Change

Delete all long-term loss of material rows from GALL and SRP, and delete the inspections recommendations for this aging effect from XI.M32.

Justification for Change

The purpose of the One-Time Inspection program is to confirm the absence of, or insignificance of, aging effects. Loss of material in raw water and waste water is expected to occur. Existing GALL rows provide for management of loss of material due to general corrosion of steel in raw water and waste water environments with ongoing programs such as XI.M20 (Open-Cycle), XI.M27 (Fire Water) or XI.M38 (Inspection of Internal Surfaces). These programs provide for inspections that are capable of identifying loss of material due to general corrosion, as previously recommended in GALL R2, and in the SLR GALL. One-Time Inspections of components exposed to raw water would be expected to find some evidence of loss of material, and the disposition of these findings would be management with the already-credited AMPs above to provide reasonable assurance that degradation is addressed before loss of component function. Additionally, reviews for recurring internal corrosion in such systems would drive applicants to augment these programs or to implement plant-specific programs to provide additional assurance of component function. Potential augmented requirements specified in SRP 3.3.2.27 (for example) include volumetric inspections, or greater numbers of inspections, additional locations, additional trending and decision points.

Loss of material for steel due to general corrosion in treated water environments is already adequately addressed by AMP XI.M2 and Water Chemistry and XI.M32 One-Time Inspection programs.

Imposition of an additional wall thickness measurement by volumetric inspection presupposes that the previously approved visual inspections for general corrosion are, or have been, ineffective. Changes to aging management, such as the determination that a specific effect cannot be detected using previously approved methods, should be driven by OE. However, this new requirement for aging management seems to be driven by postulation of hypothetical inspection failures rather than by actual operating experience.

Source 045

RESPONSE:

See the response to Comment 015-003.

<u>Comment</u>: **<u>081</u>**

Location of Change

XI.M42 baseline inspections, Topic vii

Description of Change

See comment above for XI.M42 Detection of aging effects.

Justification for Change

As above, later applicants will be crediting the M42 program which was implemented for the initial PEO, will have established a baseline for the 40-60 period, and a new baseline should not be necessary.

RESPONSE:

See the response to Comment 045-078.

<u>Comment</u>: **<u>082</u>**

Location of Change

Section G topic vii and Appendix E page E-20 XI.M42, detection of Aging Effects

Description of Change

Delete "between the 50th and 60th year of operation."

Justification for Change

This is the same as the 10-year period prior to the subsequent period of extended operation. Baseline inspections can occur between the 30th year (first license renewal) or 50th year (subsequent license renewal) of operation depending on implementation of LR-ISG-2013-01 or GALL-SLR.

RESPONSE:

See the response to Comment 045-078.

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11. ABSTRACT (200 words or less)

This document is a knowledge management and knowledge transfer document associated with NUREG–2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report," and NUREG–2192, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants" (SRP-SLR).

This document contains the U.S. Nuclear Regulatory Commission (NRC) staff's analysis of the public comments received on the drafts of NUREG–2191 and NUREG–2192. Public comment drafts of the GALL-SLR Report and the SRP-SLR were published on December 15, 2015, with the public comment period expiring on February 29, 2016. A supplement to the draft subsequent license renewal guidance documents was published on March 29, 2016, with the public comment period expiring on May 31, 2016. The disposition of comments that the NRC staff agreed with and used as the basis for instituting a change to either the GALL-SLR Report or the SRP-SLR are detailed in this document. In addition, the public comments that did not result in a change to either NUREG are also dispositioned, and the staff's technical basis for not agreeing with these comments is presented.

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