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CENG
a joint venture of
Constellation Energy   eDF

November 16, 2012

U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

ATTENTION: Document Control Desk

SUBJECT: **Nine Mile Point Nuclear Station, Unit 1**
Renewed Facility Operating License No. DPR-63
Docket No. 50-220
R.E. Ginna Nuclear Power Plant
Renewed Facility Operating License No. DPR-18
Docket No. 50-244

Verification of Information in Aging Management Technical Letter Report

REFERENCES:
(a) Letter from Y. K. Diaz-Sanabria (NRC) to J. E. Pacher (Ginna), dated October 12, 2012, Technical Letter Report on Aging Management Program Audits at Ginna and Nine Mile Point 1 (ML12277A090)
(b) Letter from Y. K. Diaz-Sanabria (NRC) to K. Langdon (Nine Mile Point), dated October 12, 2012, Technical Letter Report on Aging Management Program Audits at Ginna and Nine Mile Point 1 (ML12277A090)

On October 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued References (a) and (b) to R.E. Ginna Nuclear Power Plant (Ginna) and Nine Mile Point Nuclear Station (Nine Mile Point) to request that the stations review a Technical Letter Report resulting from aging management audits held at the stations. The requested purpose of the review is to verify that the information in the report is factually correct as it pertains to Ginna and Nine Mile Point.

References (a) and (b) requested a response within ten days of the date of the letters. In discussions with Ms. Bennett Brady (NRC, Office of New Reactors), it was agreed that, due to an outage at Ginna, the response would be sent as soon as it was feasible.

Both Ginna and Nine Mile Point have completed the requested reviews. The comments by the stations are presented in Attachment (1)

There are no regulatory commitments in this letter.

A001
NRR

If there are any questions concerning this letter, please contact me at everett.perkins@cengllc.com or 410-470-3928.

Sincerely,

Everett P. Perkins

EPP/EMT/bjd

Attachments: (1) Comments on Technical Letter Report (93 Pages)

cc: B. K. Vaidya, NRC
M. C. Thadani, NRC
W. M. Dean, NRC
Resident Inspector, Ginna
Resident Inspector, Nine Mile Point

bcc: H. B. Barron
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S. Belcher
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T. H. Darling
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D. J. Bierbrauer
T. L. Harding
J. A. Jackson
S. L. Miller
M. Fallin
E. M. Tyler

Fleet Licensing Letter 12-041

REGULATORY COMMITMENTS IDENTIFIED IN THIS CORRESPONDENCE:
None

ATTACHMENT (1)

COMMENTS ON TECHNICAL LETTER REPORT (93 PAGES)

Constellation Energy Nuclear Group, LLC
November 16, 2012

Technical Letter Report: A Summary Report of Aging Management Program Pilot Audits at Ginna and NMP-1 to Gather Information for Subsequent License Renewal

Manuscript Completed: *September 2012*
Date Published: *xxx 2012*

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Prepared for
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Washington, DC 20555
NRC Job Code V6217

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Abstract

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Executive Summary

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Acronyms and Abbreviations

AAI	Applicant Action Item
ACI	American Concrete Institute
Act	Atomic Energy Act of 1954, as amended
AERM	aging effects requiring management
AMA	aging management activity
AMP	aging management program
AMR	aging management review
ANL	Argonne National Laboratory
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BMI	bottom-mounted instrumentation
BSS	borated stainless steel
BWR	boiling water reactor
BWROG	BWR owner's group
BWRVIP	Boiling Water Reactor Vessels and Internals Project
CAP	corrective action program
CASS	cast austenitic stainless steel
CCCW	closed-cycle cooling water
CFR	*Code of Federal Regulations*
CLB	current licensing basis
CR	Condition Report
CRD	control rod drive
CRDRL	control rod drive return line
CS	carbon steel
CUF	cumulative usage factor
CVCS	chemical volume and control system
ΔP/SLC	differential pressure and standby liquid control
DER	deviation event reports
DOE	U.S. Department of Energy
ECCS	emergency core-cooling system
ECP	electrochemical potential
EFPY	effective full power year
EMDA	expanded materials degradation assessment
EPRI	Electric Power Research Institute
EPU	extended power uprate
EPIX	Equipment Performance and Information Exchange System
EQ	Environmental Qualification

EVT-1	enhanced visual examination
FAC	flow-accelerated corrosion
FME	foreign material exclusion
FW	feedwater
FWS	fire water system
GALL	NUREG-1801, Generic Aging Lessons Learned Report
GDC	general design criteria
GE	General Electric
GL	Generic Letter
GSI	Generic Safety Issue
HAZ	heat-affected zone
HPCI	high-pressure cooling injection
HVAC	heating, ventilation, and air conditioning
HWC	hydrogen water chemistry
IASCC	irradiation-assisted stress corrosion cracking
ID	inside diameter
IGA	intergranular attack
IGSCC	intergranular stress corrosion cracking
IN	Information Notice
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISI	in-service inspection
ISP	Integrated Surveillance Program
LER	Licensee Evident Report
LOCA	loss of coolant accident
LR	license renewal
LRA	license renewal application
LTO	long-term operation (i.e., operation beyond initial license namely beyond 40 years)
LTOP	low-temperature overpressure protection
MEB	Metal Enclosed Buses
MIC	microbiologically influenced corrosion
MRP	Materials Reliability Program
MRV	minimum required value
NDE	non-destruction examination
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association

NMP-1	Nine Mile Point Unit 1
NMP-2	Nine Mile Point Unit 2
NPP	nuclear power plant
NRC	U.S. Nuclear Regulatory Commission
NSSS	nuclear steam supply system
OCCW	open-cycle cooling water
OpE	operating experience
PBD	program basis document
PEO	period of extended operation
PLL	predicted lower limit
PMDA	proactive materials degradation assessment
PT	penetration test
PWR	pressurized water reactor
PWSCC	primary water stress corrosion
RAI	request for additional information
RCS	reactor coolant system
RES	NRC Office of Nuclear Regulatory Research
RG	Regulatory Guide
RHR	residual heat removal
RIS	Regulatory Issue Summary
RLSB	License Renewal and Standardization Branch
RPV	reactor pressure vessel
RVI	reactor vessel internals
RWCU	reactor water cleanup
SBO	Station Blackout
SCC	stress corrosion cracking
SER	safety evaluation report
SFP	spent fuel pool
SG	steam generator
SIT	structural integrity test
SLR	Subsequent License Renewal
SRP-LR	Standard Review Plan for License Renewal
SS	stainless steel
SSCs	systems, structures, and components
Staff	NRC staff
TGSCC	transgranular stress corrosion cracking
TLAA	time-limited aging analysis
TLR	Technical Letter Report

TR	Topical Report
TS	Technical Specification
UT	ultrasonic testing
VT	visual (inspection) testing; VT-1 detects discontinuities/imperfections, VT-2 detects evidence of leakage, and VT-3 determines general mechanical and structural condition of components
WCAP	Westinghouse Commercial Atomic Power

1. Introduction

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2. Implementation and Effectiveness of AMPs at Ginna and NMP-1

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2.3.1 XI.M1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

Ginna implements this program through its "ASME Section XI, Subsections IWB, IWC, & IWD Inservice Inspection" AMP B2.1.2 and NMP-1 through its "ASME Section XI Inservice Inspection (Subsections IWB, IWC, IWD)" AMP B2.1.1. The Ginna LRA states that its program is consistent with the corresponding GALL, Rev. 0 AMP XI.M1 with no exceptions or enhancements. It further states that its inservice inspection (ISI) program is continually upgraded to account for industry experience and research and is subject to periodic NRC inspections and self-assessments. The NMP-1 LRA states that the licensee takes exception to the corresponding GALL, Rev. 0 AMP in that examination categories B-F, B-J, C-F-1, C-F-2 and IGSCC Category A are inspected using the EPRI risk-informed methodology and implemented in accordance with ASME Code Case N-578-1, as approved by NRC plant-specific Relief Request. In addition, NMP-1 noted its related commitment to implement ASME Code Case N-730, Roll Expansion of Class 1 Control Rod Drive Bottom Head Penetrations in BWRs to eliminate leakage. However, an audit report for the Ginna AMP B2.1.2 for ASME Section XI ISI was not prepared, therefore technical information from Ginna audit, relevant for SLR, is not available for this AMP.

Comment [MRF1]: What was the impetus for this comment? Was there evidence that a QA audit was supposed to be conducted and wasn't? Those are the only audits that are ever done on any program. What are regularly performed are assessments. If there was no such evidence of a missed audit that had been planned, it is not clear what this comment is supposed to mean and is, therefore, not relevant.

The NMP-1 audit found that the licensee performs a quarterly health report that includes a review of the related industry OpE and incorporates the findings into its inspection plans, which is potentially important for an ISI program based mainly on a consensus set of ASME Code requirements. The risk-informed part of the ISI at NMP-1 also requires a review of the OpE, and it includes a voluntary commitment to additional inspections of the reactor vessel and internals, per boiling water reactor vessels and internals program (BWRVIP) guidelines [by the nuclear steam supply system (NSSS) vendor], which expand the scope of the ASME Section XI ISI requirements. NMP-1 noted its related commitment to implement ASME Code Case N-730, Roll Expansion of Class 1 Control Rod Drive Bottom Head Penetrations in boiling water reactors (BWRs) to eliminate leakage.

It was noted during the audits that plant-specific considerations, such as any risk-informed ISI, relief requests, and in the case of BWRs, some BWRVIP requirements, are likely to impact the scope and requirements of ASME Section XI ISI implementation. The GALL Rev. 2, AMP description does not address any of the differences between the inspection requirements in various editions of the ASME

Code Section XI ISI, or between these Code requirements and the industry guidelines such as in BWRVIP documents, all of which may be active in a plant-specific situation. Nor does it require the licensee to state the actual Code Edition, any Code Cases, and/or industry guidance documents, or any augmentation used in the plant implementation.

During its NMP-1 audit the staff determined that the licensee will continue to perform the system pressure tests on all ASME code class systems and components per ~~NMP-1 System Pressure Testing Program~~ASME Section XI requirements.

The staff noted that the NMP-1's request for permanent relief from examining reactor pressure vessel (RPV) circumferential welds and its proposal to perform only 2 to 3 % of the circumferential welds that intersect longitudinal welds, for the extended period of operation, was granted approval by NRC on 4/3/09. The staff also noted NMP-1's relief request for authorization to use Roll-Expansion of Class 1 control rod drive (CRD) Bottom Head penetrations with its proposal to use ASME approved code case N-730. The staff determined that NRC granted approval on 3/15/10 for NMP-1's relief request to implement the risk-informed/safety-based ISI program for Code Class 1 and 2 piping system.

The staff noted that in response to the leakage through the lower head of the NMP-1 reactor vessel penetrations for the CRD mechanisms repairs have been made by roll expanding the CRD housing in order to stop or limit the reactor coolant leakage. The staff also noted that, during the license renewal application process, NMP-1 was mandated to commit to implement ASME Code Case N-730, and that a ultrasonic testing (UT) examination of roll-expanded CRD housing shall be performed in accordance with the Code Case on at least 10% of previously rolled housing during each inspection interval.

Staff's review of plant-specific operating experience of NMP-1 revealed **deviation event reports** (DERs which have since been re-termed Condition Reports (CRs)) documenting indications of flaws in recirculation components, piping, and various nozzle connection welds and noted that deficiencies identified by the applicant's ASME Section XI ISI Program have been repaired, replaced, or evaluated as acceptable in accordance with ASME Section XI and NMP-1 implementing procedures. The staff noted that three non-conforming issues were identified during the last refueling outage (RFO 21) at NMP-1: The first was a relevant condition associated with the Steam Dryer Support Brackets. The second was a flaw in reactor vessel head to flange weld. The third was damaged threads on a nut removed from a valve. The reactor vessel head to flange flaw exceeded the acceptance criteria of IWB-3510 [the indication was subsurface, 1.129" in the through wall dimension, and 79" long] which has been determined to be an original fabrication defect. The staff noted that the licensee performed a flaw evaluation determining that the indication was acceptable for continued operation, and the evaluation was submitted to NRC for approval on June 28, 2011.

During the NMP-1 audit, the staff also noted current ISI program has been tracking 8 previously identified flaw indications that were conditionally accepted by analytical evaluation and accepted by the NRC, for which flaw re-examination will continue to be performed as required by ASME Code. No adverse trend based on the program owner's experience. The staff found that NMP-1 has not completed a program assessment in the last three years but has plans to perform a rigorous snapshot self-assessment prior to the end of 2011 and to request a Focused Self Assessment to be scheduled for 3Q or 4Q 2012. The staff determined that the NMP-1 Fourth 10-year ISI Plan will meet GALL 2 AMP XI.M1 since both were developed based on the 2004 Edition of ASME Code Section XI. The staff's future guidance included considering better use of On-Line Monitoring and advanced non-destructive examination (NDE) technology such as Acoustic Emission Testing.

2.3.2 XI.M2 Water Chemistry

Ginna implements this program through its "Water Chemistry Control" AMP B2.1.37 and NMP-1 through its "Water Chemistry Control Program" AMP B2.1.2. The Ginna LRA states that its program is consistent with the corresponding GALL, Rev. 0 AMP XI.M2 with the exception that it uses updated editions of the EPRI primary and secondary water chemistry control guidelines. The Ginna LRA cites EPRI Topical

Comment [MRF2]: All of the discussions in this report relative to GALL Report identified Code versions are inappropriate. With each new version of the ASME Code that is reviewed and approved by the NRC, part of the NRC's review is to ensure that the aging management aspects of code required inspections are not lost from one version to the next. So, when each licensee updates code versions per 10 CFR 50.55a, they are automatically performing the requisite aging management activities and it doesn't matter which version of the code is referenced in the GALL Report. As a result of this, licensees in their LRAs no longer have to take exception to code versions that are contained in the GALL Report because of 10 CFR 50.55a and the NRC's review process of the Code.

Additionally, in the ISI Plan that every licensee has to submit to the NRC for each 10 year Inspection Interval, any exceptions that the licensee wishes to take to the code are addressed as relief requests from the code for which alternative Code Cases, etc. are proposed. These are reviewed on a case by case basis and either approved by the NRC, or are further enhanced as required by the NRC, and then documented as approved via an SER. The NRC, through the 50.55a process and through its specific review of each licensee's ISI Plan every 10 years, approves the aging management that is inherent and specifically included in the plan activities and inspections.

Licensee's used to have to take exception to the Code version included in the GALL Report until the ACRS had DLR make sure that NRR reviews each new version of the Code with 10 CFR 54 based aging management activities in mind. Once it was established that this was true, because of 50.55a, the ACRS deemed that exceptions to the specific Code years cited in the GALL Report were no longer needed. When both Ginna and NMP1 submitted their LRAs, DLR was still requiring the exception.

BTW, Both NMP1 and Ginna are currently on the 2004 version of the Code with no addenda.

Report (TR)-105714, Rev. 4 for primary systems chemistry and EPRI TR-102134, Rev. 5 for secondary systems chemistry. NMP-1 likewise takes an exception to GALL in that, when the NRC-approved EPRI or BWRVIP water chemistry guidance document cited in the GALL Report is updated, they utilize the updated document. Their amended LRA cites EPRI TR-103515, Rev. 1 and 2. In addition, the NMP-1 program takes an exception in that electrochemical potential (ECP) is monitored only under hydrogen water chemistry (HWC) operation, and ~~both NMP-1 and NMP-2~~it also takes exception~~s~~ to the GALL recommendation for monitoring of hydrogen peroxide, because accurate measurement of this chemical is extremely difficult due to its rapid decomposition in the sample lines. As an alternative, ~~they~~ it monitors the molar ratio of hydrogen to oxygen, consistent with EPRI TR-103515, Rev. 2.

During the Ginna audit, it was noted that the licensee performs monthly self-assessments on both primary and secondary water chemistry as a part of the water chemistry program. With the information obtained, repetitive findings are identified and tracked. The results of such monthly self-assessments provide a basis for the continued improvement of program effectiveness. Ginna implemented a 17% power uprate at the beginning of Cycle 33 (Fall of 2006), and, during the subsequent Cycle 34 (beginning in the Spring of 2008), iron transport was a little higher as indicated by a review of primary and secondary chemistry. During Cycle 34, approximately 89 lbs of iron oxides were transported by the feedwater (FW) to the steam generators. Ginna has just entered fuel cycle 37 in the Fall of 2012. At present, only limited OpE (a few operating cycles) is generally available with respect to the possible effects of power uprate on water chemistry control.

During the recent audit, a review of water chemistry OpE at NMP-1 revealed problems in implementing their HWC, noble metal chemical application, and zinc FW additions programs. These problems in controlling levels of chemical additives, which have been compounded by numerous failures of the computer system that controls the hydrogen addition levels, have resulted in rather wide ECP fluctuations and elevated Co-60 levels in the coolant. Ginna also reported water chemistry control problems. The problems generally involved levels of specific impurities exceeding EPRI guidelines, particularly during startup and transient operating conditions and are being addressed in the corrective action program.

2.3.3 XI.M3 Reactor Head Closure Stud Bolting

Ginna implements this program through its "Reactor Head Closure Studs" AMP B2.1.25 and NMP-1 through its "Reactor Head Closure Studs Program" AMP B2.1.3. However, the Ginna LRA states that ISI portion of this program is included in its AMP B2.1.2 "ASME Section XI, Subsections IWB, IWC, & IWD Inservice Inspection" discussed above. It further states that preventive actions are not necessary because their reactor head closure studs are fabricated from ASME SA-320 Grade L43 (AISI 4340) low-alloy steel, and thus are not susceptible to SCC (specified minimum yield strength of 105 ksi). The Ginna LRA further states that a comprehensive discussion of bolt and stud cracking is provided in their AMP B2.1.5, "Bolting Integrity." NMP-1 implements this program through its "Reactor Head Closure Studs Program," AMP B2.1.3. However, this AMP takes exception to GALL, Rev. 0 guidance, which cites ASME Code requirements covered in the 1995 edition through the 1996 addenda. The IWB, IWC, and IWD ISI programs for NMP-1 and NMP-2 are based on the 1989 Code edition with no addenda.

It was noted during the Ginna audit that the Ginna bolting integrity program is based on NUREG-1339, which recommends a maximum yield strength less than 150 ksi (1034 MPa). However, its reactor head closure studs bolting program is not consistent with this recommendation. For example, as stated above, the reactor head closure stud bolting program states that the closure studs are fabricated from SA-320 Gr. L43 (AISI 4340) low-alloy steel with minimum yield strength of 105 ksi (724 MPa), and thus are not susceptible to SCC. ~~The Ginna safety evaluation report (SER) (NUREG-1786) identified this exception and stated that it is possible that the studs could have been heat treated to yield strength of 150 ksi (1034 MPa) and could be susceptible to SCC.~~ The SER further adds that since the reactor head closure studs program relies on ASME Section XI, Subsection IWB, to monitor for SCC, this aging effect will be managed by this program. Based on the review of OpE, Ginna generates and reviews program health reports for the ASME Section XI ISI Program, which includes inspections of the reactor head closure studs. The purpose of these reports is periodic assessment and improvement of program effectiveness.

Comment [MRF3]: The audit was done for NMP1 only; therefore, there should be no mention of NMP2 in this report.

Comment [MRF4]: The Chemistry Supervisor and BWRVIP AMP Owner indicate that there have only been issues with HWC, not with noble metal or zinc addition. The reason for the HWC challenges was hydrogen supply piping unavailability in 2008 and 2009, not computer system anomalies. NMP1 upgraded the HWC supply piping and the HWC system to eliminate system spurious trips and is now achieving 98% availability. It is true that when the HWC system trips, the plant experiences ECP fluctuations and Co60 variations; but, that is a consequence of the trip. It would be more appropriate to say that NMP1 has experienced HWC reliability issues which did not reduce HWC system effectiveness below the required 95% level. NMP1 has addressed these reliability issues with improved HWC system piping and system controls and is now achieving the industry guideline goal of 98% availability.

Comment [MRF5]: It is not that unusual to have chemical species anomalies during startup and transients and is when you would suspect they might occur if and when they are to occur at all.

Comment [MRF6]: See Comment MRF 2

Comment [MRF7]: This statement in the SER was suppositional and had no basis in fact relative to Ginna. There is nothing in the Ginna documentation relative to this bolting material that indicates heat treating was utilized. For this reason, the SER should not have included this statement; therefore, it is felt that it should not be duplicated in this report.

The licensee also indicated that these health reports have not identified a significant concern related to this program.

The audit also found that NMP-1 RV closure head studs have experienced very little degradation. A review of plant-specific OpE revealed that only a few deviation event reports (DERs) have been written as a result of inspections of stud assemblies, and none of these dealt with aging-related defects.

Comment [MRF8]: See editorial on P. 24 which would allow the acronym only here.

2.3.4 XI.M4 BWR Vessel ID Attachment Welds

This AMP is not applicable to Ginna, since it is a pressurized water reactor (PWR). NMP-1 implements this program through its "BWR Vessel ID Attachment Welds Program," AMP B2.1.4. The NMP-1 LRA states that this program is consistent with GALL, Rev. 0 AMP XI.M4, but it also states that the program is implemented through its "BWR Vessel ID Attachment Welds Program," AMP B2.1.8. Furthermore, the attributes of the BWR Vessel ID (inside diameter) Attachment Welds Program related to maintaining reactor coolant water chemistry are discussed in the program description for the NMP-1 "Water Chemistry Control Program" (AMP B2.1.2).

The NMP-1 audit found that, during the spring 2011 refueling outage (N1R21), enhanced visual examination (EVT-1) of the steam dryer support brackets revealed relevant indications in the heat-affected zone (HAZ) of three of the four brackets [made of high-C A240 Type 304 stainless steel (SS)]. The cause of indications was identified as IGSCC, possibly due to residual stresses in the weld-sensitized bracket, and applied dryer deadweight loads. As part of its acceptance criteria/corrective actions, the licensee recommended re-inspection during the N1R22 outage and revision of the flaw evaluation procedure to incorporate clear acceptance criteria for re-examination and to demonstrate the retention of adequate margin between N1R21 as-found indication data and the allowable criteria. If no changes in cracking are evident, then successive EVT-1 exams will be performed in subsequent outages, and if any significant change in cracking is apparent, a repair will be developed for implementation during N1R23.

It was also noted during the audit that the NMP-1 AMP is consistent with GALL, Rev.0 AMP XI.M4. .

2.3.5 XI.M5 BWR Feedwater Nozzle

This AMP is not applicable to Ginna, since it is a PWR. NMP-1 implements this program through its "BWR Feedwater Nozzle Program," AMP B2.1.5. The NMP-1 LRA states that this program is consistent with GALL, Rev. 0 AMP XI.M5 with one exception and that it is implemented through its ISI Program. The exception to GALL Rev. 0 AMP, XI.M5 is that the NMP-1 1SI Program does not comply with the specific edition and addenda of ASME Section XI cited in the GALL. The reason being that the program is updated to the latest Edition and Addenda of ASME Section XI, as mandated by 10 CFR 50.55a, prior to the start of each 10-year inspection interval (as discussed on page I-1 of the GALL Report).

Comment [MRF9]: See Comment MRF 2

It was noted during the audit that UT and ~~penetration~~ penetrant test (PT) inspections required by NUREG-0619, as recommended by GALL, have been superseded, because the inspections are now performed in accordance with ASME Code Section XI, Appendix VIII. However, supporting fracture mechanics analysis for the FW nozzles (NER-1M-006, Rev. 02, NMP-1 FW Nozzle Fatigue Evaluation), which was last updated in 1999, references BWR owner's group (BWROG) Report No. GE-NE-523-A71-0594, which defines alternative inspection requirements to NUREG-0619 report. It is not clear whether the alternative requirements in the BWROG report were invoked, or whether the report was being used as guidance. Furthermore, the fracture mechanics analysis has not been updated to account for the license renewal work.

Comment [MRF10]: This whole evolution of Feedwater Nozzle inspection requirements was very convoluted and was reviewed in detail by an NRC expert in this area during the IP71002 inspections to ensure that the inspections were being performed to current requirements. All was found to be consistent with NRC expectations and there was no need to revise the fracture mechanics analysis for LR. For this report to call that into question now is not appropriate. This is particularly the case now that the inspections have evolved to being done per the ASME Code and the plant has to follow the latest version of the Code per 50.55a. Additionally, the usage of the nozzle is being monitored by FatiguePro under the Fatigue Monitoring Program.

With respect to OpE, the LRA states that NMP-1 detected significant FW nozzle cracking in 1977. A liquid PT examination of one FW nozzle performed in 1981 showed that no new cracks had been identified since the 1977 inspection and repairs. To minimize the potential for fatigue crack initiation, modifications meeting the requirements NUREG-0619 (including cladding removal, improved thermal sleeve/FW sparger design, rerouting of reactor water cleanup piping to the FW line, and improved FW flow control) were completed for the NMP-1 FW system. A series of calculations was performed to evaluate stress, fatigue usage, and crack growth of an assumed flaw projected to the end of life of the plant (40 years) as a function of number of operating cycles; these analyses formed the basis for the enhanced ISI program for the FW nozzle implemented at NMP-1. During the 1999 refueling outage (RFO15), an in-service UT of the four FW nozzles discovered no reportable indications.

In 1999, the original stress, fatigue, and crack growth analyses were revised to meet the requirement to use the updated ASME Code fatigue curves and to incorporate changes in fatigue cycle definitions (magnitude and frequency of load cycles) based on updated plant data assumptions. These calculations include assumptions of numbers of transients occurring over a one-year period, and a determination of the low-cycle fatigue usage for the FW system nozzles. Based on an anticipated number of startup/shutdown/scram cycles per year, annual fatigue usage was calculated to be 0.003 per year.

2.3.6 XI.M6 BWR Control Rod Drive Return Line Nozzle

This AMP is not applicable to Ginna, since it is a PWR. NMP-1 implements this program through its "BWR Control Rod Drive Return Line Nozzle Program," AMP B2.1.37. The NMP-1 LRA states that this program is consistent with GALL, Rev. 0 AMP XI.M6 with three exceptions. The first exception involves the edition of the ASME Code used as the basis for the Section XI requirements. GALL, Rev. 0 AMP XI.M6, identifies the 1995 edition (including the 1996 addenda) of ASME Section XI as the basis for the GALL CRD return line (CRDRL) nozzle program. The NMP ISI Program does not comply with the Edition and Addenda of ASME Section XI cited in the GALL because the program is updated to the latest Edition and Addenda of ASME Section XI, as mandated by 10 CFR 50.55a, prior to the start of each inspection interval. The second and third exceptions involve the inspection method and frequency for performing the augmented inspection requirements in NUREG 0619. In lieu of PT examination every sixth refueling outage or 90 startup/shutdown cycles, whichever comes first, NMP-1 performs enhanced ultrasonic examination every 10 years.

Comment [MRF11]: See Comment MRF 2

It was noted during the audit that no cracking was found during PT examinations of the NMP-1 CRDRL nozzle in 1977 or during subsequent examinations. During RFO15, an in-service UT of the CRDRL nozzle discovered no reportable indications (attachment to letter from Niagara Mohawk Power Corporation (NMP1L 1489) to U.S. NRC dated December 13, 1999). A welded-in-place thermal sleeve design makes the NMP-1 CRDRL nozzle less susceptible to thermal fatigue cracking than the original designs at other BWRs. In 1994, an analysis evaluating crack growth for an assumed flaw in the CRDRL nozzle showed that small surface flaws would not grow to unacceptable values within the original 40-year license period.

The CRD return line safe-end and the thermal sleeve were replaced in 1978 with modified design to improve resistance to both IGSCC and fatigue. The replacement thermal sleeve material is low-carbon Type 316L SS, and the thermal sleeve is welded to the safe-end with low-carbon Type 308L weld filler. To reduce the probability of fatigue, the thermal sleeve pipe protrudes 7 inches out from the flow shield, which promotes mixing away from the vessel wall thus preventing thermal cycling at the vessel wall and at the flow shield. No impact on the relevant AMPs was noted during the audit.

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2.3.7 XI.M7 BWR Stress Corrosion Cracking

This AMP is not applicable to Ginna, since it is a PWR. NMP-1 implements this program through its "BWR Stress Corrosion Cracking Program," AMP B2.1.6. The NMP-1 LRA states that this program is consistent with GALL, Rev. 0 AMP XI.M7 with the exception that GALL, Rev. 0 AMP XI.M7, cites ASME Section XI requirements covered in the 1995 edition through the 1996 addenda for the evaluation of any detected indication. The AMSE Section XI program~~s~~ for NMP-1 ~~and NMP-2 are~~ is based on the 1989 edition of the Code with no addenda.

It was noted during the audit that the AMP basis documents NRC Generic Letter (GL) 88-01 and BWRVIP-75-A state that the detection of cracking is based on the use of well-qualified techniques and personnel specifically for the IGSCC as observed in the past OpE. In addition, while the basis documents continue to provide the best available guidance on IGSCC management, it is essential for future OpE to confirm continued effectiveness for operating periods beyond 60 years. In addition, it was noted that a review of some program self-assessment reports indicates that an HWC system may not be meeting industry goals for its operability and that the HWC system design changes to enable low-power hydrogen injection may not be receiving deserved or desired attention. In addition, the long-term strategy for ECP monitoring and coupons may need better coordination between chemistry, systems, and design groups/programs. The low-power HWC injection capability to improve the HWC availability may be a critical long-term strategic initiative; particularly, relatively short periods of HWC unavailability are expected to allow pre-existing indications to grow even after the hydrogen level is returned to service level. This limited availability of HWC during certain operating conditions can lower the potential mitigation effect during the PEO or ~~long-term operation (LTO)~~subsequent license renewal (SLR). This is particularly relevant for NMP-1, where, as noted above in Section 2.1.2, problems in implementing and controlling the HWC program have been experienced.

Finally, NMP-1 OpE in general indicates the presence of sulfate spikes due to resin release (intrusions) from demineralizers. High sulfate levels have the potential to significantly accelerate SCC of BWR piping during and subsequent to such intrusions. Cumulative effects of these intrusions can be significant over the current and subsequent PEO~~s and LTOs~~.

Demineralizer resin intrusion can also increase sulfate levels in the reactor coolant and treated water.

2.3.8 XI.M8 BWR Penetrations

The NMP-1 BWR Penetrations Program manages the effects of cracking due to SCC in the various penetrations of the reactor pressure vessels made of steel, stainless steel and nickel alloy. This program is based on guidelines issued by the BWRVIP and approved by the NRC. The attributes of the BWR Penetrations Program related to maintaining reactor coolant water chemistry are included in the Water Chemistry Control Program (amended LRA Section B2.1.2). The BWR Penetrations program performs inspections and flaw evaluations in accordance with approved BWRVIP-49 and BWRVIP-27. In addition, the inspection and flaw evaluation for lower plenum components are performed in accordance with BWRVIP-47 as part of the BWRVIP Program. The applicant did not identify an exception or enhancement in comparison to the GALL Rev. 1 Report. This AMP is not applicable to the Ginna plant because it is a PWR.

During the NMP-1 visit, the staff noted that based on the BWRVIP-27 guidance, the weld inspection and evaluation program for the penetration-to-safe-end weld of the core ΔP/SLC nozzles with stainless steel

Comment [MRF12]: See Comments MRF 2 and MRF 3.

Comment [MRF13]: See Comment MRF 4. Additionally, Relative to HWC low power addition, there is a mod being installed during the 2013 RFO that will allow HWC addition at 5% power which will take care of this issue.

Comment [MRF14]: NMP1 has an effective ECP program and it is, therefore, not an issue. The NMCA coupons are no longer used for predicting when to apply NMCA since NMP1 is using the online injection method which re-applies on an annual basis independent of coupons. The only issue is the long term use for the coupons since the original basis is no longer required and not viable for online NMC methods.

Comment [MRF15]: See Comment MRF 13.

Comment [MRF16]: It is very important to note here that since NMP1 implemented the iron pre-filters modification, the frequency of resin intrusions/sulfate transients has decreased significantly.

safe ends, recommends an enhanced VT-2 inspection until a qualified UT is available. Furthermore, the feasibility of an appropriate volumetric examination for the ΔP/SLC nozzle locations is being evaluated. The NMP-1 program also indicated that although the UT technique used during the 1999 refueling outage was demonstrated to be appropriate for the stainless steel safe ends (examination of ~~GL~~ GE SIL 571), it was not demonstrated to be appropriate for the weld because it did not meet the current BWRVIP-03 recommendations for UT demonstration.

The NMP-1 OpE indicates that the Unit 1 CRD stub tubes have experienced cracking due to IGSCC of stub tubes fabricated from furnace sensitized austenitic stainless steel. The licensee indicated that the system leakage test per the ASME Code is performed during every refueling outage, and "best effort inspections" are performed for the stub tubes because they are not accessible during the normal refueling outage activities. However, the licensee has voluntarily committed to additional inspections of the NMP-1 reactor vessel and internals. During the last eighteen years of operation, cracks and leakage have been detected in the CRD stub tubes using EVT-1 and VT-2 examinations, respectively. The exception was stub tube 50-19 in which EVT-1 could not identify cracking. The licensee indicated that inspection of the CRD stub tube 50-19 was deferred because safe access to the lower head was determined to be not feasible and an acceptable inspection method ~~is~~ was not currently available.

Repairs of the cracked or leaking stub tubes have been made by roll expanding the CRD housing. The licensee stated that following roll repair, a zero leakage condition has been observed in all cases. To date 33 CRD penetrations have been roll expanded to a nominal 4% wall thinning. Of these, only one penetration~~s~~ (50-19) has been re-roll expanded to 6% wall thinning due to repeat occurrence of leakage. No leakage has been observed at this penetration since it was last roll expanded in 2005. In the event the roll expansion procedure does not seal a CRD penetration within allowable leakage criteria, the licensee is seeking NRC approval for an alternative weld repair strategy, which includes variations from the requirements of ASME Code Case N-606-1.

The NMP-1 OpE indicates the HWC has been effective to mitigate SCC of CRD stub tubes. However, in relation to the implementation of HWC, the staff noted that licensee's Program Health Report (7/1/2011 – 9/30/2011) for the BWR Water Chemistry Program indicates that HWC system is not meeting industry goals of 98%. The program health report also indicates that this item is one of the top 3 concerns of the program health and planned modification to HWC system to improve the system's capability of meeting 98% [industry] goals is not adequately prioritized for engineering resources. ~~The program health report also indicates that the long term strategy for ECP monitoring and coupons is not coordinated between chemistry, systems, and design.~~

Comment [MRF17]: See Comments MRF 4 and 13.

Comment [MRF18]: This last sentence should be deleted since it is not a true statement. The system Health Report notes that a long term strategy for the ECP and coupons is required because with online NMC, the original purpose has changed and the coupons are not required. No issues exist impacting ECP monitoring or the ability to monitor online NMC effectiveness. The original coupon strategy is being maintained, however, and NMP is working with the industry on how best to use this system with online NMC addition.

2.3.9 XI.M9 BWR Vessel Internals

[redacted]

[redacted]

The BWR Vessel Internals Program is an existing program that is consistent with the recommendations of GALL Rev. 0 XI.M9. NMP-1 has committed to enhance the BWR Vessel Internals Program to address the following:

(i) The BWRVIP-18 open item regarding inspection of inaccessible welds for core spray system. As such, NMP-1 will implement the resolution of this open item as documented in the BWRVIP response, and reviewed and accepted by the NRC.
(ii) The inspection and evaluation guidelines for steam dryers are currently under development by the BWRVIP committee. Once these guidelines are documented, and reviewed and accepted by the NRC, the actions will be implemented in accordance with the BWRVIP program.
(iii) The baseline inspections recommended in BWRVIP-47 for the BWR lower plenum components will be incorporated into the appropriate program and implementing documents.
(iv) A schedule for additional inspections of the top guide locations (using EVT 1 or techniques demonstrated to be appropriate in BWRVIP-03) will be incorporated into the appropriate program and implementing documents. A minimum of 10% of the locations will be inspected within 12 years of the beginning of the period of extended operation, with at least 5% of the inspections completed within 6 years.

NMP-1 has committed to follow the status of the proposed ASME Code change with respect to allowing roll / expansion techniques for CRD stub tubes. Implement final code change or provide alternative plan for period of extend operation at least 1 year prior to expiration of original Operating License. Also, the AMP will be enhanced to manage the effects of loss of fracture toughness due to thermal aging and neutron embrittlement on the structural and functional integrity of potentially susceptible cast austenitic stainless steel (CASS) components. In addition, an EVT-1 examination of the NMP-1 FW sparger end bracket welds will be performed. The inspection extent and frequency of the end bracket weld inspection will be the same as the ASME Section XI inspection of the FW sparger bracket vessel attachment welds.

Comment [MRF19]: This is in the past. The site has approved and budgeted the contingency for a CRD Stub Tube leak weld repair, if needed, during the 2013 RFO. NRR is reviewing the modified BWRVIP-58 repair methodology that has been submitted.

The site-specific OpE at NMP-1 includes core shroud cracking, shroud support weld cracking, CRD stub tube IGSCC cracking and leakage, and top guide cracking.

Core Shroud Horizontal Weld Crack: NMP-1 identified core shroud horizontal weld cracking following the BWRVIP-01 baseline inspection in 1995. The corrective action taken was to install a pre-emptive core shroud tie-rod repair, which followed the BWRVIP-02 shroud repair guidelines.

Core Shroud Vertical Weld Crack: NMP-1 identified core shroud vertical weld cracking in 1997 following a baseline inspection required by BWRVIP-02 guidelines. A pre-emptive repair was installed in 1999 for the core shroud vertical welds. NMP-1 has also identified indications in the core shroud support H9 vessel attachment weld during baseline BWRVIP-38 inspections in 2001. The indications were analyzed consistent with BWRVIP-38 methods and judged to remain acceptable considering a 10-y re-inspection frequency. Supplemental inspections on a sampling basis have been performed that have shown the indications are confined to the weld with no propagation into the vessel low alloy steel. The 2009 core shroud vertical inspection has demonstrated that no new vertical weld cracking has occurred. The inspection however has shown that the severely cracked V9 and V10 welds have continued to grow in depth and are effectively through wall. This condition is bounded by the design assumption used for the vertical weld clamps on V9 and V10.

Top Guide Grid Beam Baseline Inspection: The inspection of the top guide performed in refueling outage18 (April 2005) was a UT of approximately 100% of the accessible grid beam using the General Electric (GE) top guide grid beam UT tool. The inspection results identified similar indications as found in the 1996 inspection of the Oyster Creek top guide inspection. Based on the BWRVIP-26-A evaluation and the boat sample testing of the Oyster Creek top guide crack sample the most likely cause of the indications is IASCC. The best estimate neutron fluence for the top guide was 4.4E+21 n/cm^2 at the time of the top guide UT performed in 2005. This fluence is well above the IASCC threshold of 5E+20 n/cm^2.

The UT results were analyzed and determined that the top guide remain operable for continued service without restrictions. This analysis justifies a re-inspection frequency of 10 years.

License Renewal Top Guide Grid Beam Inspection: The re-inspection scope and frequency for the grid beam going forward will be based on BWRVIP-26A guidance for plant-specific flaw analysis and crack growth assessment. The maximum re-inspection interval for the grid beam will not exceed 10 years consistent with standard BWRVIP guidance for the core shroud. The re-inspection scope will be equivalent to the UT baseline, refueling outage 18 (**2005**) inspection scope. In addition, the re-inspection will include EVT-1 inspection of at least two locations with accessible indications within the initial 6 years of the 10-year interval. The intent of the EVT-1 is to monitor the known cracking to confirm flaw analysis crack growth assumptions. Per discussion with the AMP program owner, UT of top guide will be repeated in refueling outage 22 (**2015**).

Core Spray Annulus Piping: The welds were examined during refueling outages 14, 15, and 16 (1997, 1999, and 2001) in accordance with BWRVIP-18. No cracking ~~has been~~was identified in the creviced or P3A welds. The welds were visually re-examined per BWRVIP-18-A in refueling outage 19 (2007) and no indications were identified. In refueling outage 20 (2009), an indication in Weld P6-U3A was identified. During refueling outages 18-20 (2005, 2007, and 2009), various Condition Reports (CRs) were initiated to identify poor visual inspection coverage due to access limitations. License Renewal commitment 13 requires NMP-1 to implement the BWRVIP resolution of inaccessible welds for the core spray system. This LR commitment was completed based on NMP-1's commitment to implement new/revised BWRVIP requirement.

The above deficiencies identified by the BWRVIP Program activities have been repaired, replaced, or evaluated per BWRVIP program guidelines and station implementing procedures. The program manager for the BWR Vessel Internals program is required to provide reports for the following

The following adverse trends were identified in the Program Health Report:

(a) Any decision to not fully implement an NRC-approved BWRVIP guideline.
(b) Flaw assessments that deviate from the guidance in BWRVIP Reports. These assessments shall be submitted to the NRC for approval prior to implementation. .
(c) Inspection intervals that deviate from NRC approved guideline.

2.3.10 XI.M10 Boric Acid Corrosion

Ginna implements this program through a plant-specific Administrative Procedure developed to meet the recommendations of GL 88-05. The Ginna LRA states that this program will be developed consistent with GALL, Rev. 0 AMP XI.M10 by enhancing it to account for boric acid corrosion of non-reactor coolant system (RCS) components located in areas where there is the potential for boric acid leakage, including cable connections, cable trays and other susceptible SSCs. As stated in the Ginna SER, "This AMP is credited with managing the aging of carbon steel (CS) and low-alloy steel structures or components or electrical components on which borated water may leak in the RCS, engineered safety features, steam and power conversion system, structures and component supports, and electrical systems. The applicant's program was developed and implemented to meet GL 88-05 'Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants,' and to monitor the condition of the RCS pressure boundary components for boric acid leakage. The program identifies CS components within the RCS that are susceptible to corrosion from boric acid leakage and provides for visual inspection of adjacent components." This AMP is not applicable to NMP-1, since it is a BWR.

Consistent with the guidance of NRC Regulatory Issue Summary (RIS) 2003-013, the Ginna AMP includes the identification of reactor coolant system locations that contain nickel alloys or welds (e.g., control rod penetrations) for inspections. At Ginna, an initial inspection by a team of pipe fitting and decontamination staff, examines relevant surface when the system is "as hot as possible," to identify locations of interest. The second team composed of a VT-2 qualified inspector (who has boric acid training per EPRI 1022326) and a trainee or support engineer, later implement follow-up activities. Ginna plant personnel stated that they specifically look for rust-colored stains in their visual examinations of boric acid deposits. They also stated that when leakage is identified within the containment or in an area with enclosed ventilation units, the ventilation units are evaluated for evidence of boric acid deposits. This activity of examining and evaluating the ventilation units for evidence of boric acid wastage residue is of particular importance in view of the operating experience at Davis Besse.

The program looks at two characteristics for findings: (1) whether the leak is still active and (2) the volume, color and location of deposits. The plant personnel stated that they do not restart with active leaks, consistent with the technical specification (TS) and they "try" to leave no deposits. Their program incorporates a fluid leakage management program for borated systems that looks at leakage severity and considers the risk of locations that have been exposed to leakage. Locations with high and low risk are generally repaired immediately, whereas low risk locations may be combined into a single CR for remediation. Their implementing procedures include provisions for replacement with non-susceptible materials. It was stated that Ginna continues to find and correct boric acid leakage, with a fairly constant number of CRs identified at each refueling outage.

Comment [MRF20]: This doesn't seem to make sense.

2.3.11 XI.M11B Cracking of Nickel-Alloy Components and Loss of Material due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWR only)

The AMP XI.M11B in the GALL Report (NUREG-1801, Rev. 2) replaces AMPs XI.M11, "Nickel-Alloy Nozzles and Penetrations" GALL. Rev. 0 and XI.M11A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors" in GALL, Rev. 1. It addresses the issue of cracking of nickel-alloy components and loss of material due to boric acid-induced corrosion in susceptible, safety-related components in the vicinity of nickel-alloy reactor coolant pressure boundary components.

This AMP is not applicable to NMP-1, since it is a ~~PWR~~BWR. At Ginna, this program is implemented through the plant-specific AMP Section B2.1.26 "Reactor Vessel Head Penetration Inspection Program" that is described in the LRA as being consistent with no exceptions or enhancements with the guidelines provided in GALL. Rev. 0 AMP XI.M11, "Nickel-Alloy Nozzles and Penetrations." It also complies with NRC Order EA-03-009, "Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," issued on February 11, 2003. Ginna implements this AMP by incorporating the ASME Code, Section XI, Subsection IWB, Table IWB 2500-1 (1995 edition through the 1996 addenda) to detect PWSCC and its effect on the intended function of the components, crediting its Water Chemistry Control Program (LRA Section B2.1.37), and addressing the industry-wide initiative relative to NRC GL 97-01.

Comment [MRF21]: See Comment MRF 2

During the Ginna audit, the staff noted that AMP XI.M11 has changed significantly since GALL, Rev. 0 and Rev. 1 and that significant new OpE has been gained. These changes have been actively updated at Ginna following industry guidance, and the licensee has plans to implement latest revisions of the Code Cases (which is not in GALL, Rev. 2) and that it is tracking the performance of PWSCC-resistant materials like Alloy 690 and its welds. In particular, the staff noted that the program scope of GALL, Rev. 2 AMP XI.M11B includes additional nickel-based components and associated welds of the reactor coolant pressure boundary within its scope and manages the loss of material due to boric acid corrosion in the vicinity of susceptible nickel-based components, with related updates of final rule 10 CFR 50.55a requiring augmented inspections. The staff's review of licensee actions and response to these changes showed that its AMP implementation to manage the PWSCC issues is being updated to be consistent with the guidance in GALL Report, Rev. 2 AMP XI.M11B and 10 CFR Part 50.55a requirements.

The staff's review of licensee's recent OpE showing steam generator (SG) tube denting and sludge hardening due to off-normal secondary water chemistry indicated a need for better understanding and integration of such instances in the transfer of this OpE to other related AMPs and inspections in order to assess their impact on program effectiveness. The staff also considered this OpE relevant for the

Operating Experience Precursors and Aging Management Indicators, as noted in the Fatigue Monitoring Program, for further consideration. During Ginna audit, in its review of the recent Ginna OpE regarding boric acid leakage, the staff noted that the licensee should continue to monitor and trend the inspection results for its bottom-mounted instrumentation (BMI) penetrations. The licensee should further confirm that visual examination of the reactor vessel head bottom areas without the removal of coatings is adequate to detect and manage PWSCC and boric acid corrosion effects of the BMI penetrations. The staff's review of Ginna's program trending information suggested that the AMP appears to be effective to detect and manage the intended aging effects.

Comment [MRF22]: Studies have been completed that indicate that this type of coating contains micro cracks that reveal leakage with minimal pressure. The site has confirmed that the Ginna bottom head coating does have such micro cracking. The bottom head is visually inspected each RFO even though the requirement is for every other RFO. Volumetric examinations of the BMI penetrations have also been performed that have resulted in a single indication at one BMI weld which, upon evaluation, is believed to have occurred during initial fabrication.

In addition, staff's review of the monitoring and trending program element and the corrective actions program element of AMP XI.M11B indicated a need to evaluate more specific guidance on how the leakage monitoring and trending activities should be used to take necessary actions for effective aging management.

Comment [MRF23]: This statement should be reworded to identify what specific document provides the more detailed guidance that the staff felt needed to be evaluated. If there is not a specific document that can be cited, the statement should be removed.

2.3.12 XI.M12 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)

[redacted]

[redacted]

[redacted]

No significant exception or enhancement is identified in the Ginna LRA SER. The ongoing ASME Section XI ISI examinations are credited for the aging management of the CASS piping and piping components. Based on the licensee's plant-specific flaw tolerance evaluations in consideration of thermal aging effect on CASS components, the licensee demonstrated that flaw stability and safe serviceability of the CASS components for the period of extended operation. Therefore, no additional augmented inspections are necessary to manage thermal aging embrittlement of these components.

The Ginna plant OpE indicated that the ISI has not revealed any indication on the CASS piping or piping components.

This AMP is not applicable at the NMP-1 because its ASME Section XI ISI (Subsections IWB, IWC, IWD) program requirements are considered adequate for all potentially susceptible CASS components at NMP-1.

2.3.13 XI.M14 Loose Part Monitoring

At NMP-1, the "Loose Part Monitoring" AMP XI.M14 of GALL, Rev. 0 and Rev. 1 was stated to be not applicable as it was not credited for aging management, and the program was not implemented. Ginna Station also does not implement the XI.M14 program as an aging management activity, although its LRA describes "Loose Part Monitoring" in Section B2.1.19 that lists twelve ~~other~~ AMPs at Ginna that work together to provide this function~~, as an alternative approach, related~~ relative to the reactor coolant system and reactor vessel internals. The LRA also notes that there is a loose parts monitoring system employed

Comment [MRF24]: AMPs…not "other AMPs" since there is no Loose Part Monitoring AMP

for the steam generators, called the digital metal impact monitoring system (DMIMS), which is not considered to be an aging management program but rather a reactive measurement system to detect failed or foreign material exclusion (FME) components that have inadvertently entered the steam generators.

During Ginna audit, the staff noted that the purpose of Ginna's counterpart to GALL AMP XI.M14 is to rely on in-service monitoring to detect and monitor loose parts in the power plant, in lieu of measures to monitor and detect metallic loose parts with acoustic signal data analysis, as intended in GALL, Rev. 0. This edition of GALL, in the Chapter 4 line items (Reactor vessel, internals, and RCS) AMR using AMP XI.M14, always coupled it with GALL AMP XI.M1 to manage the loss of preload due to stress relaxation. Revision 1 of GALL did not apply AMP XI.M14 to any AMR line item. The staff noted that Ginna AMP as described in Section B2.1.19 of its LRA is not consistent with the GALL Report, and that early detection and monitoring during normal operation for loose part damage are not addressed. Instead, the LRA program relies on the absence of any loose parts and/or the non-occurrence of severe/rapid damage from any loose part in these systems. However, based on acceptable plant-specific experience, as noted by Ginna in response to an earlier LRA request for additional information (RAI) 2.2.2-4 (May 13, 2003), and the use of ASME Code Section XI ISI to manage loss of preload due to stress relaxation, the NRC staff agreed that loose parts monitoring did not appear necessary. The staff's SER and subsequent inspection/audit reports did not evaluate this program for license renewal, since it was not credited for any AMR items for SSCs within the scope at Ginna.

Comment [MRF25]: These statements are inappropriate since there is no credited Ginna AMP or program for loose parts monitoring; therefore, there can be no comparison of a non-existent AMP or program to the GALL Report.

Also, during Ginna audit, the staff's search of the EPIX (Equipment Performance and Information Exchange System) database, looking at CR and corrective action program (CAP) records for any significant incidence of loose parts in the primary coolant system and the reactor vessel internals, found only that there were various cases of high false alarm rates, over-sensitivity, and limited capability for interpreting alarms and signals.

2.3.14 XI.M15 Neutron Noise Monitoring

This AMP is not applicable to NMP-1 since it is a BWR. Ginna does not have a separate aging management program corresponding to GALL, Rev. 0 AMP XI.M15, but instead describes ~~it under the "Neutron Noise Monitoring"~~ 2 existing AMPs that provide applicable functionality in Section B2.1.20 of its LRA. This section notes that the changes in support structures (such as the core support barrel's upper support flange) are managed by its other AMPs, namely the "ASME Section XI, Subsections IWB, IWC, IWD, Inservice Inspection Program" (Section B2.1.2) and the "Reactor Vessel Internals Program" (Section B2.1.27).

During Ginna audit, the staff noted that the purpose of GALL AMP XI.M15 is to rely on monitoring during operation the excess neutron detector signals due to core motion to detect and monitor significant loss of axial preload at the core support barrel's upper support flange. It was also noted that GALL, Rev. 0 had only two Chapter IV (Reactor vessel, internals, and RCS) AMR line items that invoked AMP XI.M15, both of which were coupled with AMP XI.M1 and AMP XI.M14 to manage the loss of preload. The staff further noted that in GALL, Rev. 1, XI.M15 was not used for any AMR line item, and in NUREG-1950 (the basis document for GALL, Rev. 2) the AMP XI.M15 was eliminated due to lack of relevance and very limited previous usage in submitted LRAs. The existing Ginna AMP, as described in Ginna LRA Section B2.1.20, does not employ any neutron noise monitoring system for the reactor vessel internals, but instead relies on two other AMPs. During the audit at Ginna Station, the staff searched the EPIX database containing CR/CAP records and observed that further work should be done to verify if any increase in clearances and wear of mating surfaces at the barrel upper support area were observed in the related inspections or operating experience history at Ginna. Of interest was how these observations were evaluated in relation to the loss of axial preload consideration, and in relation to the alternate two AMPs that B.2.1.20 references. Also, during the Ginna audit, the staff conducted confirmation analysis of the method or assessment used by the licensee to determine and/or manage the loss of axial preload at the upper support flange of the core support barrel, based on the periodic inspections performed under its ISI and Reactor Vessel Internals programs. The Ginna staff stressed that the ISI program examined

Comment [MRF26]: Again, this LRA section specifically states that there is no Ginna AMP for Neutron Noise Monitoring.

head bolting and hold-down springs, and that the leakage monitoring detected any leakage into the space between the related O-rings. Any increase in clearances and wear of mating surfaces at the barrel upper support area (between inspections) are assumed to be small enough to have little impact on the loss of preload and/or axial restraint, and to have been rectified if necessary during the next outage.

2.3.15 XI.M16A PWR Vessel Internals

The Reactor Vessel Internals (RVI) Program approved for Ginna in the SER was a plant-specific version of the AMP in GALL Revision 0. The LRA stated that Ginna would monitor ongoing industry initiatives and modify its program "appropriately to incorporate industry lessons learned." The program as identified in the LRA is based on augmentation of the ASME Section XI ISI Program for certain susceptible or limiting components or locations. One aspect of the program cited in the LRA was augmentation to enable detection of fine cracks in non-bolted components with enhanced visual examination methods capable of resolving 0.0005 inch features of interest.

During the Ginna plant audit, the licensee stated that it had implemented the initial inspection under its program consistent with Materials Reliability Program (MRP)-227, Revision 0, and will update their program through a comparison with MRP-227-A to determine their path forward to ultimately achieve consistency with MRP-227-A. During the Ginna plant visit, the licensee stated that they may require deviations which they will justify through the MRP-227-A process. This AMP is unusual in that it is dependent on industry development of, and NRC approval of, a topical report to guide the development of inspection plans by PWR plants. As described above, the examinations that have been implemented by Ginna are not necessarily reflective of those that they will implement to achieve consistency with MRP-227-A during the period of extended operation. This AMP is not applicable to the NMP-1 plant because it is a BWR.

Comment [MRF27]: This statement doesn't seem appropriate since the entire BWRVIP, the counterpart program for BWRs, was generated in the same manner.

The PWR Vessel Internals program uses a combination of visual and ultrasonic examination methods to detect discontinuities and imperfections (such as loss of integrity at bolted or welded connections, loose or missing part, debris, corrosion, wear or erosion) and verify parameters (such as clearances, settings, and physical displacements). One exception was cited in the LRA and the SER, which anticipated that some augmented examinations specified in the industry recommended program may be performed only once, in contrast to the ISI Program frequency of 10-years. Since the applicant identified that their required inspections and frequency of inspection would depend on the results of the industry program on PWR Vessel Internals program, the only significant RAI was a commitment by the applicant to ultimately submit their PWR Vessel Internals program for NRC review and approval prior to entering the period of extended operation. The applicant ultimately did submit their program for NRC review and approval, which was not reviewed pending acceptability of the industry program, as embodied in the MRP-227 report. With the issuance of MRP-227-A and consistent with the guidance of RIS 2011-07, Ginna stated that it will withdraw its RVI program submitted for NRC review and approval and re-submit it within one year and consistent with MRP-227-A.

Comment [MRF28]: The submittal was sent to the NRC consistent with the provisions of the RIS.

The Ginna PWR Vessel Internals program inspections included significant interactions with a U.S. Department of Energy (DOE) program that is addressing long-term plant operation. Therefore, the results of the inspections will be provided in various reports and papers. In addition, ~~adverse~~ findings from the inspections will be documented through the MRP process to all PWR licensees, and the inspections modified accordingly. The applicant specifically discussed the following examinations (including some background):

- Baffle-to-Former bolts
  - With DC Cook finding baffle bolt heads at the bottom of its reactor pressure vessel (lower core support plate), additional criteria were added at Ginna to visually examine the bolt head welds (locking device) as a first step.
  - Surry operating experience of ~ 1-2 UT indications out of 1080 bolts inspected.
  - Beznau found unsatisfactory UT results in 2009.

- In 1999, ~~they~~ Ginna **replaced 56 out of 728 bolts** after UTs of the 639 accessible bolts. **Although** ~~44~~ 59 bolts **were identified as having** ~~cracks~~indications, **laboratory examination** of the 54 removed bolts that didn't fail upon removal identified only 1 with a crack, indicating that the ultrasonic test method employed at that time was conservative.
- In 2011, ~~Their~~ Ginna's target was to demonstrate a minimum bolting pattern of 121 bolts plus a 50% margin which would justify operation for 10 years, with an assumption that 50% of the 728 bolts failed.
- Observations from the inspections:
  - Bolt removal productivity rate was much slower than anticipated (18 bolts per day were scheduled and only 4-5 per day were actually being removed).
  - In higher fluence region, had issues with putting bolts back in; left 3 open holes at the end of the outage.
  - Some fuel impingement and structural impact from jetting.
  - Removed 28 bolts ~~and~~, performed **UT** on 24 bolts, undamaged by removal, **from the back side (non-shank end)**, and identified no issues. Installed 25 new bolts.
  - ~~Did~~ Performed UT on ~~~155 other bolts~~the 56 bolts installed in 1999 and 99 original bolts and found only 1 indication in an original bolt.
- Current plant-specific acceptance ~~analysis~~ analyses by Areva and Westinghouse in conjunction with 1999 and 2011 inspection results **for current condition** ~~justifies~~ justify ~~one cycle of operation; they will analyze to try to demonstrate~~ **acceptable operation until** the **next** ~~10-year ISI~~MRP-227 inspection in 10 years.

- No indications **from** the following additional vessel internals visual inspections:
  - ~~Visual~~ VT-3 of core barrel circumferential welds from inside diameter and some from the outside diameter ~~identified no indications~~.
  - ~~Visual~~ VT-3 of clevis pin insert screws (Cook found cracking).
  - ~~Visual~~ EVT-1 of lower flange weld of guide tubes.
  - ~~Visual~~ VT-3 ~~of wear~~ of guide cards.
  - ~~Visual~~ VT-3 of flexures.
  - ~~Visual~~ EVT- 1 of upper core barrel to flange weld from ID and OD.
  - ~~Visual~~ VT-3 of baffle plate seams.
  - ~~Visual~~ VT-3 of edge bolts.

As discussed above, additional changes will be made to make this program consistent with MRP-227-A. Once modified for consistency with MRP-227-A and submitted for NRC review and approval, the AMP will be consistent with ~~the planned ISG-LR~~LR-ISG-2011-04 to make the GALL Rev. 2 AMP consistent with MRP-227-A.

2.3.16 XI.M17 Flow-Accelerated Corrosion

Ginna implements this program through its "Flow-Accelerated Corrosion" AMP B2.1.15 and NMP-1 through its "Flow-Accelerated Corrosion Program" AMP B2.1.9. The AMPs at Ginna and at NMP-1 are based on Rev. 0 of the GALL Report, and both LRAs state that the respective AMPs are consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion," with no exceptions or enhancements. Both the LRAs note that their AMPs are in accordance with the Electric Power Research Institute (EPRI) guidelines in the Nuclear Safety Analysis Center (NSAC)-202L, Revision 2, and both utilize CHECWORKS predictive code.

During the Ginna audit, the site personnel noted that the program basis document was revised showing that the Service Water piping and the Fire Protection piping were removed from its flow-accelerated corrosion (FAC) program scope, and the CHECWORKS model was converted and updated to SFA Version 2.1. The staff found that Ginna's most recent Program Health Report provided an excellent picture of the program's implementation and the status of current ~~and~~ issues, and that the program appeared to address other wall thinning mechanisms like cavitation, even though these mechanisms do not meet the definition of flow-accelerated corrosion. In addition, the staff noted that the site upgraded to NSAC-202L, Rev. 3 which is consistent with GALL Rev. 2. During the NMP-1 audit, the site's most recent Program Health Report (3rd Quarter 2011) provided a comprehensive picture of the program's implementation and related issues, and based on the health report, the program appeared to be working well. Also, the staff noted that the FAC Program inspection scope did not need to be expanded during the last outage from the initial plan and that the FAC-related repairs or replacements had been anticipated based on prior inspection results, indicating that the program was managing the associated aging effect effectively. From an OpE perspective, the Program Health Report also maintained a list of relatively recent plant-specific and industry issues along with the disposition for each item. This provided documentation that operating experience was being effectively considered and evaluated as part of the AMP at NMP-1. Consequently, no specific changes to the AMP for future guidance were identified during the NMP-1 audit.

2.3.17 XI.M18 Bolting Integrity

Ginna implements this program through its "Bolting Integrity" AMP B2.1.5 and NMP-1 through its "Bolting Integrity Program" AMP B2.1.36, both of which are based on GALL, Rev. 0. The NMP-1 LRA states that its program will be consistent with GALL Report NUREG-1801 after completing enhancements, as stated in Commitment #33 in Appendix A of its LRA, prior to entering the PEO. The NMP-1 LRA notes that its bolting integrity program is implemented through the ASME Section XI ISI Programs (for subsections IWB, IWC, IWD, IWE, IWF), the Structures Monitoring Program, the Preventive Maintenance Program, and the Systems Walkdown Program. The Ginna LRA states that its bolting integrity program is consistent with the GALL Report NUREG-1801, with no exceptions, enhancements or commitments, and that it credits activities performed under the direction of other aging management programs for managing specific aging effects.

The Ginna audit confirmed that its Bolting Integrity Program, although cited as a separate program, does not implement any activities itself, but instead credits activities performed under several other AMPs for managing specific aging effects associated with bolting. During the Ginna audit, it was also noted that the applicant's program basis document identified that one of these credited AMPs, namely, its Structures Monitoring Program, was not consistent with the GALL AMP in that additional tests for detecting degradation of structural bolting and fasteners, such as hammer tests, in-situ ultrasonic tests or proof tests by tension or torquing were not planned unless specifically required as a result of a potentially degraded condition. The implementation of this Ginna AMP was not evaluated because all inspection activities are conducted through the implementation of other AMPs. The Ginna audit found no condition reports specifically connected with its Bolting Integrity Program, so no corrective actions could be evaluated relative to this program. Also, the Ginna operating experience review reports consistently stated that either no inspections were performed or no conditions were noted. During the Ginna audit, it was noted that the program basis document was revised in April 2009. From the audit, no technical strengths, or weakness, or conclusions could be drawn from this program, based on its implementation at Ginna.

The NMP-1 audit noted the NRC inspectors reviewed the commitments associated with this program, during its IP 71003, "Post-Approval Site Inspection for License Renewal," and concluded that the licensee had enhanced the Bolting Integrity, Structures Monitoring, and System Walkdown Programs as stipulated in Commitment No. 33. The NMP-1 audit also noted that, although the program was not included in any recent program health report, the licensee's recent self-assessment concluded that there were no issues with the AMP. This report also stated that the licensee had identified and inspected all high-strength bolting and had included any condition monitoring requirements for the remaining bolting in the Structures Monitoring and Systems Walkdown inspection checklists. Based on the NMP-1 audit review showing no condition reports or other indication of problems with the program, the AMP appeared to be effective, and no specific changes to the AMP for future guidance were identified during the audit.

2.3.18 XI.M19 Steam Generators

Ginna implements this program through its "Steam Generator Tube Integrity" AMP B2.1.31, based on the guidance documents NEI 97-06 and EPRI TR-107569. The Ginna AMP is consistent with GALL Report

(NUREG-1801) Section XI.M19, "Steam Generator Tube Integrity." This AMP is not applicable to NMP-1, since it is a BWR.

In view of the recent industry OpE on the PWSCC of nickel-based alloys in the SG divider plate assemblies and tube-to-tubesheet welds, which were not in the program scope of the AMP, the staff requested the licensee to provide its actions in addressing the aging management of these SG components. The staff determined that the licensee program does not include activities to detect and manage the potential PWSCC of these SG locations. During the Ginna audit, the staff also found that, despite the use of PWSCC-resistant Alloy 690 tubing, the autogenous welds with Alloy 82 and related dilution effects on material composition need to be addressed for managing their PWSCC potential and that enhanced visual examination can be viable for its detection. It was noted that qualified eddy current techniques for the tube-end welds have not yet been developed. The staff also noted that the Ginna licensee performed 100% visual inspections of the divider plate weld areas during the last two SG inspections (2008, and 2011), with no detectable degradation, confirming that the inspections are performed to manage the divider plate weld PWSCC, consistent with the guidance of GALL, Rev. 2.

During Ginna audit, the staff also noted that the licensee's TS require maintaining a SG Tube Integrity Program that is consistent with the industry guidance NEI 97-06 (Rev. 2) basis for the SG AMP. Therefore, the staff requested further clarification as to whether the licensee's AMP and TS requirement differ in any attributes or objectives and how the two programs are updated to maintain consistency with periodic updates in industry/NRC guidance. The licensee did not identify any difference in programs attributes and stated that the basis document belongs to its SG AMP and not to its TS program, which is based on its plant procedures.

As part of the audit of the SG AMP implementation at Ginna, the staff reviewed licensee's performance concerning the potential for degradation due to foreign objects and noted that GALL, Rev. 2 addresses FME Program. The licensee indicated that it has a Foreign Object Search and Removal (FOSAR) Program implemented in SG vendor procedures and that their OpE indicates foreign object exclusion to be a potential concern related to the material degradation in SG components.

During the Ginna audit, the staff noted that the licensee's Program Health Reports, License Renewal Related Condition Reports and Trends Reports periodically assess the OpE related to the SG Program and associated components, thus continuing to maintain the effectiveness of the program [redacted]

2.3.19 XI.M20 Open Cycle Cooling Water System

This program is implemented at Ginna through its "Open-Cycle Cooling (Service Water) System AMP B2.1.22. The Ginna AMP lists the following two exceptions to GALL, Rev. 0 AMP XI.M20: (1) heat transfer tests are not performed on selected small heat exchangers that are periodically cleaned and inspected in accordance with the Ginna AMP B2.1.23, "Periodic Surveillance and Preventive Maintenance Program," and (2) the Ginna AMP does not address protective coatings, which are not credited for aging management in the Ginna Service Water System. The program basis document was updated in April 2009, by adding specific references to the license renewal service water system program plan and requiring completion of generic service water system inspection checklist. Both the Ginna Service Water System Reliability and Optimization Program (B2.1.22) and the amended NMP-1 LRA Open Cycle Cooling Water System Program (B2.1.10) cite the guidance given NRC GL 89-13 and 10 CFR Part 50, Appendix B, which is also included in GALL, Rev. 2.

NMP-1 implements this program through its "Open Cycle Cooling Water System Program," AMP B2.1.10. The NMP-1 AMP identifies no exceptions, but it lists the following enhancements: (1) ensure that the applicable NMP-1 commitments made for GL 89-13, and the requirements in NUREG-1801, Section XI.M20 are captured in the appropriate NMP-1 documents; (2) where the requirements of GALL XI.M20 are more conservative than the GL 89-13 commitments, they will be incorporated into the NMP-1 AMP; and (3) revise the NMP-1 ~~and NMP-2~~ preventive maintenance and heat transfer performance test procedures to incorporate specific inspection criteria, corrective actions, and frequencies. Revision 1 of the program basis document was issued November 10, 2009, which discussed problems with the eddy current inspections of the containment spray cooling heat exchangers due to manufacturing variations. The document noted that these variations made the heat exchangers un-inspectable with conventional eddy current and stated that pressure tests from the shell side verify no tube leakage. Other changes to some of the implementing procedures were noted, but these did not appear to be the result of specific problems with the program or the result of enhancements due to aging related operating experience.

Comment [MRF29]: See Comment MRF 3

It was noted during the Ginna audit that increased roughness was observed at the inner surfaces of open-cycle cooling water (OCCW) system piping due to the formation of tubercles and other ongoing fouling mechanisms. This aging mechanism impacted the piping internal roughness assumptions used in developing acceptance criteria. Specifically, due to the increased roughness from this aging mechanism, it was determined that the current acceptance criteria established for pressure requirements may not provide sufficient flow through the affected piping in the event of a loss of coolant accident (LOCA). Since this configuration is not tested due to the adverse effects of introducing raw water into the SGs, additional steps may need to be taken to address this aspect.

As stated above, Ginna took an exception to GALL guidance that calls for heat transfer tests on selected small heat exchangers in the OCCW system; instead, their program relies on periodic cleaning and inspection.

The July–Sept. 2011 System Health Report for the Service Water System at NMP-1 noted that the heat exchanger performance was very good, but discussed the condition of the emergency service water piping condition and the need to replace 14-inch discharge piping because of wall thinning. It also noted that much of the small-bore piping is in "a generally degraded condition." As a result, through-wall leaks occur at an "unacceptable" frequency of approximately one per year for 3-inch and smaller diameter piping. Furthermore, the frequency of leaks is increasing. The report also stated that the current practice at NMP-1 is to repair service water piping leaks when they occur.

Comment [MRF30]: Funding has been approved to replace all 3" and under piping from 2015 through 2020. The 14" Emergency Service Water discharge piping is also funded for replacement over the next 2 RFOs in 2013 and 2015.

2.3.20 XI.M21A Closed Treated Water System

This program is implemented at Ginna through its "Closed-Cycle (Component) Cooling Water System" AMP B2.1.9. However, Ginna takes an exception to GALL, Rev. 0, in that EPRI TR-107396 is not referenced in Ginna procedures, and the only parameters monitored are pH, corrosion inhibitor concentrations, and radioactivity. NMP-1 implements this program through its "Closed-Cycle Cooling Water System Program" AMP B2.1.11. The NMP-1 program takes no exceptions to GALL, Rev. 0, but adds a number of enhancements to make it consistent with GALL. These enhancements include (1) expanding periodic chemistry checks of closed-cycle cooling water (CCCW) systems consistent with the guidelines of EPRI TR-107396, (2) implementing a program to use corrosion inhibitors in accordance with the guidelines given in EPRI TR-107396, (3) performing periodic inspections to monitor for loss of material in the piping of the CCCW systems, (4) implementing a corrosion monitoring program for larger bore CCCW piping not subject to inspection, (5) establishing inspection frequencies for degradation of components in CCCW systems, (6) performing a heat removal capability test for the NMP-1 Control Room heating, ventilation, and air conditioning (HVAC) system at least every 5 years, (7) establishing periodic monitoring, trending, and evaluation of performance parameters for several CCCW systems, (8) specifying chemistry sampling frequencies for the NMP-2 Control Building Ventilation Chilled Water System, (9) providing the controls and sampling necessary to maintain water chemistry parameters in CCCW systems within the guidelines of EPRI Report TR-107396, and (10) ensuring that acceptance criteria are specified in the implementing procedures for the applicable indications of degradation.

It was noted during the NMP-1 audit that the licensee had modified its commitment regarding the implementation of corrosion inhibitors, in accordance with EPRI guidelines, in the reactor building closed cooling and control room heating ventilation and air conditioning systems prior to PEO. The commitment was changed, through the prescribed change process, to maintain a pure-water-system chemistry, in accordance with EPRI guidelines, which required the addition of an oxygen removal skid to maintain specified levels.

The NMP-1 Program Health Report and System Health Report include~~s~~ the results of periodic assessments of the implementation of the NMP CCCW system program, list~~s~~ any degradation observed, and summarize~~s~~ the overall status of the system. The most recent report stated that the AMP is working well, but because of finding degradation in system components, applicable preventive maintenance frequencies have been increased from every third cycle to every cycle.

~~In a related issue, t~~The NMP-1 program basis document for the CCCW system reported numerous incidents of pipe leaks. These included 7 incidents of pipe wall thinning from 1996 to 2003 and 10 occurrences of leakage at threaded and mechanical joints from 2001 to 2003. These failures were attributed to a combination of general, galvanic, and flow-assisted corrosion as well as inadequate design of threaded joints and inadequate wall thickness (schedule 40 rather than the schedule 80 pipe used in replacement). Further investigation revealed multiple problems over the years with maintaining nitrogen overpressure in the system surge tank and with multiple system leaks that required significant system makeup over time. These problems appear to have resulted in higher than specified levels of dissolved oxygen in the CCCW chemistry and consequent corrosion problems. This is an aging issue that has potentially significant implications for SLR, since the CCCW system serves a number of safety-related functions, including emergency diesel generator cooling, the control room HVAC, and heat exchangers in the shutdown cooling system.

Comment [MRF31]: The failures were specific to Reactor Building Closed Loop Cooling which, as you note parenthetically, has all been replaced. Additionally, relative to the dissolved oxygen issues, an oxygen removal skid has been installed as addressed in the 2nd paragraph of this section. This paragraph should, therefore, be the 2nd paragraph of this section.

A review of the condition reports for Ginna did not indicate any significant degradation problems in the CCCW system.

2.3.21 XI.M22 Boraflex Monitoring

Ginna incorporates boraflex neutron absorber panels in its spent fuel pool. However, reliance on the neutron absorption capability of the boraflex panels was discontinued when the NRC approved License Amendment 79 on December 7, 2000. That amendment provided for reliance on soluble boron instead of the boraflex. Therefore, Ginna has no AMP corresponding to GALL AMP XI.M22. Ginna also relies on borated stainless steel for neutron absorption, and aging of this material is manages by its AMP B2.1.30, "Spent Fuel Pool Neutron Absorber Monitoring," which is similar in scope to the GALL Rev. 2 AMP XI.M40, "Monitoring of Neutron-Absorbing Materials Other Than Boraflex." This AMP is discussed in Section 2.1.37 of this report.

NMP-1 implements this program through its existing "Boraflex Monitoring Program" AMP B2.1.12. With enhancements, the AMP is consistent with the recommendations of GALL, Rev. 0 X1.M22 "Boraflex Monitoring." The enhancements to the NMP-1 program include performing periodic in-situ neutron attenuation testing ~~and~~ which serves to **measure**~~ment of~~ boron areal density to confirm the correlation of the conditions of the test coupons to the conditions of the Boraflex racks that remain in use during PEO. In addition, the program includes monitoring and trending requirements for in-situ test results, silica level, and coupon surveillance test results. The program manages aging of Boraflex degradation by conducting coupon surveillance testing, performing in-situ neutron attenuation testing and monitoring silica concentration in spent fuel pool (SFP). The NMP-1 spent fuel pool originally had eight Boraflex racks in the spent fuel pool, but only two of these racks remain. Two **re-rack** campaigns were performed in 1999 and 2004, which replaced most of the original Boraflex and the remaining original equipment non-poison racks with Boral racks. ~~NMP-1 credits its existing "Boraflex Monitoring Program" AMP B2.1.12 for managing aging effects of both the Boral and Boraflex racks.~~

Comment [MRF32]: This is not correct. Boral is not managed under the Boraflex Monitoring Program. NMP1 made a specific commitment during the licensing of the SFP expansion to monitor Boral and this is done under its own plan.

The silica concentration in the NMP-1 spent fuel pool is monitored on a monthly basis for trending. Unpredicted excursion in the rate of increase in silica levels was not observed in this audit. Based on review of the AMP implementation documents and discussion with the AMP program owner, the audit found that the NMP-1 Boraflex Monitoring Program appears to be effective in managing the degradation of Boraflex panel and no significant degradation problems ~~was~~ were found.

2.3.22 XI.M23 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Ginna implements this program through its "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems" AMP B2.1.18 and NMP-1 through its existing "Inspection of Overhead Heavy Load and Light Load Handling Systems Program" AMP B2.1.13. The AMPs implemented by both Ginna and NMP-1 ~~has~~ have been consistent with the GALL, Rev. 0, AMP XI.M23. NMP-1 had the following commitment in the SER Appendix A prior to PEO: "Revise applicable procedures related to the Crane Inspection Program to add specific direction for the performance of corrosion inspections, with acceptance criteria, for certain hoist lifting assembly components."

The AMP in Ginna is mainly a visual and external surface monitoring program to detect corrosion or wear of equipment that is primarily used during refueling outages to lift spent fuel from the spent fuel pool. The components in the scope of the program are passive components including bridge, trolley, rails, stops, and lifting devices. The remaining parts of the crane have been screened out as being active and subject to replacement based on qualified life. All cranes are inspected annually except for cranes in containment, which are inspected on 18-month cycles during outages. The results for the inspections are included in work orders in the MHE-201 procedure for managing corrosion prior to entering PEO. For the 2011 refueling outage during PEO, the inspection results are in the MHE-201 procedure and on the License Renewal Aging Management Check Lists.

During the audit, the licensee stated that the cranes at Ginna are indoors and ~~the~~ that no corrosion has ever been found during inspections. One crane failure has occurred at Ginna and that was during original construction. This failure was due to human error and was not aging related. Most cranes are visually accessible for inspection. The inspection frequency is consistent with GALL.

The program in NMP-1 includes (1) performance of various maintenance activities on a specified frequency; and (2) pre-operational inspections of equipment prior to lifting activities. The program is consistent with GALL, Rev. 0 AMP XI.M23 after incorporating an enhancement requiring pre-lift corrosion inspections of certain hoist lifting assembly components.

The audit did not find any major issues and no new aging effect was identified for the SLR. However, it is noted that Ginna and NMP-1 AMPs are based on GALL, Rev. 0. ~~It is also noted that the OpE of the AMPs in Ginna and NMP-1 may not consider some recent crane accidents cited in NRC Information Notice (IN) 2009-20, "Degradation of Wire Rope Used in Fuel Handling Applications". IN 2009-10 describes significant crane wire failures in the LaSalle, Beaver Valley, and Browns Ferry stations. IN 2009-20 also suggests following measures for preventing crane rope degradation and corrective action.~~

- ~~Fleet-wide inspection of wire rope in similar use and establishment of a program to replace the wire ropes on a set frequency.~~
- ~~Establish new repetitive preventive maintenance tasks to perform fuel transfer equipment cable and sheave inspections~~
- ~~Enhance inspection schedule to monitor the condition of the distorted wire rope until the rope could be replaced.~~

Comment [MRF33]: As with Comment MRF 7, this is suppositional. The NRC Lead for this effort and other NRC personnel were shown on several occasions how each of the sites has addressed INs when they are received and there is no evidence presented that the sites did not effectively address these INs. Removal of the highlighted content should, therefore, be considered.

2.3.23 XI.M24 Compressed Air Monitoring

~~This program is implemented at Ginna through its "Compressed Air Monitoring" AMP B2.1.10~~. ~~However,~~ Ginna states in its LRA that the air-operated valves in the plant were verified to be fail-safe on loss of air, and that therefore the compressed air systems at Ginna Station did not perform a safety function. It was concluded that the Ginna plant air systems are not within the scope of license renewal~~, and the NRC staff did not evaluate this AMP during the LR process~~. During the AMP effectiveness audit, the licensee stated that aging effects on components within the system were managed through the site's "System Monitoring" AMP B2.1.33. NMP-1 implements this program through its "Compressed Air Monitoring Program" AMP B2.1.14. NMP-1 made specific exceptions to any maintenance recommended in EPRI TR-108147 that is not also endorsed by the equipment manufacturers, and to the preservice and IST guidelines of ASME OM-S/G-1998, Part 17. NMP-1 also added the following enhancements: (i) develop new activities to manage the loss of material and SCC, and perform periodic system leak checks; (ii) expand the scope, periodicity, and inspection techniques to ensure that the aging of certain sub-components of the dryers and compressors are managed; (iii) develop and implement activities to address the failure mechanism of SCC in unannealed red brass piping; (iv) establish activities that manage the aging of the internal surfaces of CS piping and that require system leak checks to detect deterioration of the pressure boundaries; and (v) expand the acceptance criteria to ensure that the aging of certain subcomponents of the dryers and compressors are managed.

~~Even though Ginna stated that its plant air systems are not within the scope of license renewal and its Compressed Air Monitoring AMP was not evaluated during the license renewal process, that program was reviewed during the present audit~~. During that audit, the licensee stated that aging effects on components within the system were managed through the site's system engineering program. A self-assessment of the instrument air system was performed in 2010, which evaluated the adequacy of the current program with recommendations 4 and 5 given in the applicant's document SOER 88-1, "Instrument Air System Failures." The licensee identified eight improvements during their assessment to strengthen the program. In addition, condition reports including receiver tank wall thickness measurements indicated that the program was effectively identifying issues. An independent review of Ginna OpE did not indicate any significant problems in the compressed air system.

At NMP-1, comprehensive visual walkdown inspections of the compressed air system components are performed at two-year intervals, based on the plant's refueling cycle, and monthly walkdowns of selected components accessible during plant operation. Instrument air sampling components are inspected at either three- or six-month intervals. With respect to OpE at NMP-1, external corrosion has been seen in some non-safety-related screenwells, and work orders to address this problem have been issued. Internal and external cracking of red brass components in the system has been a problem in the past, and all of the red brass components in the system have since been replaced. No other significant component replacements have taken place.

2.3.24 XI.M25 BWR Reactor Water Cleanup System

The BWR Reactor Water Cleanup System (RWCU) Program manages the effects of SCC or IGSCC to maintain the intended function of austenitic stainless steel piping in the RWCU system. This program is based on the NRC criteria related to inspection guidelines for RWCU system piping welds outboard of the containment isolation valve as delineated in NUREG-0313, Revision 2, and GL 88-01. The program performs volumetric examinations on the welds included in the scope of the program. The licensee's fourth interval ISI program indicates that two IGSCC Category E welds located outboard of the primary containment isolation valves are included in the inspections. The licensee implemented the guidance of BWRVIP-75-A to the augmented inspection program per GL 88-01. This is consistent with the GALL Report. However, an exception is taken to the acceptance criteria program element in that NMP-1 utilizes the 1989 edition with no addenda of the ASME Section XI code versus the 1995 edition through the 1996 addenda as defined in the GALL Report. This AMP is not applicable to the Ginna plant because it is a PWR.

Comment [MRF34]: This is incorrect since there is no Compressed Air Monitoring AMP.

Comment [MRF35]: There was no AMP to be reviewed.

Comment [MRF36]: This AMP was not reviewed because it does not exist. What was reviewed were the System Health Reports and the assessment that was performed on the system.

Comment [MRF37]: This sentence appears out of place since it does not relate to Compressed Air Monitoring. It should be deleted.

Comment [MRF38]: See Comment MRF 2.

No significant change in procedures was identified in the staff's review of the on-site documentation and interview with the licensee. The licensee indicated that when the installation of new components is planned, a design change package is reviewed and the owner of the program related to the new equipment and design change package is informed of the review process.

Comment [MRF39]: This statement is not unique to the BWR Reactor Water Cleanup System AMP and appears out of place here. It should, therefore, be deleted.

The licensee's fourth 10 year interval ISI plan ~~indicates~~ indicated that two non-safety, non-Code-Class welds in the reactor water cleanup system experienced through-wall leakage. The inspection plan further ~~indicates~~ indicated that these welds are located outboard of the primary containment isolation valves. In addition, SER Section 4.7.5.1 ~~indicates~~ indicated that the leakage ~~is~~ was due to IGSCC. The two non-safety welds were repaired using weld overlays (SER Section 4.7.5.1), and assigned to Category E. The fourth interval inspection plan also ~~indicates~~ indicated one weld out of the two welds ~~is~~ was inspected within the first 6 years of the interval. This classification is considered to provide reasonable assurance to manage aging effect of the RWCU system outboard welds. However, the staff finds that this approach of no other inspection of the total 30 outboard welds is not consistent with the recommendation in the GALL Report.

The licensee indicated that no separate health report is generated for this program. However, the Health Report for the ASME ISI Program includes the inspection activities for the welds included in the program scope of this AMP. In addition, the staff noted that the licensee generates system health reports, which indicate that one of the top issues for the RWCU system is system pressure and flow oscillations (five occurrences during the first half of 2010). Pressure oscillations ranged from 2-8 psig, while flow oscillations ranged from 10-80 gpm. One potential concern related to this system health assessment is that the pressure and flow oscillation may increase mechanical vibrations of the components in the system, which can cause vibration-induced cracking of the components. Therefore, it is recommended to further evaluate industry's OpE in terms of the potential effect of pressure and flow oscillations on vibration-induced cracking of the components subject to the oscillations.

2.3.25 XI.M26 Fire Protection

Ginna implements this program through its "Fire Protection" AMP B2.1.13. As stated in Ginna LRA and SER, the Fire Protection (FP) AMP manages aging effects (loss of materials, increased hardness and shrinkage, cracking and spalling of steel, elastomeric, and concrete materials) on the intended function of the penetration seals, fire barrier walls, ceilings, and floors, and all fire rated doors (automatic or manual) that perform a fire barrier function.

NMP-1 implements XI.M26 "Fire Protection" through its existing "Fire Protection Program" AMP B2.1.16. The NMP-1 FP AMP is consistent with GALL XI.M26 with exceptions and enhancements. The AMP takes an exception to the GALL AMP requirement for bi-monthly inspections of hollow metal fire doors and monthly inspection of the Halon/carbon dioxide suppression system valve lineup. The enhancements to the AMP are as follows: (i) Incorporate periodic visual inspections of piping and fittings in a non-water environment such as Halon and CO_2; (ii) Expand the scope of periodic functional tests of the diesel-driven fire pump to include inspection of engine exhaust system components for corrosion; and (iii) Perform an engineering evaluation to determine the plant specific inspection periodicity of fire doors. In inspection of corrosion of fire pump exhaust system, a borescope was sent down into the exhaust pipe ~~two times/year~~ to verify that corrosion has not occurred.

At Ginna, previous fire barrier inspection results, action reports, and maintenance work requests shows that fire seals, barriers, and walls remain intact to perform their intended function. Inspections have identified event-driven degradation such as torn Hymec wrap, damaged fire seals, and cracked mortar/caulk in walls. No evidence of age-related degradation has been detected. Trending reports and system health reports for the Ginna Fire Protection AMP are prepared at Ginna on a quarterly basis. Trending reports were analyzed in the audit; it does not appear that there is any significant number of condition reports since 2008. Only three were really related to the FP program, and they were both only at low category of concern.

The Ginna Fire Protection AMP includes aging management of fire breaks, fire wraps, and grout. These items are passive components that are not included in the GALL Report. A Fire break is a passive fire protection feature of construction intended to limit flame propagation along vertical or horizontal cable tray runs. The fire wrap is a passive fire and/or heat resistant covering (e.g., Hymec Wrap) used to protect or shield safe shutdown circuits. Aging effects and aging mechanisms of fire break and fire wrap are identified in the Ginna AMP. Visual inspections of fire doors and verification of clearances are performed on a quarterly basis, and not bimonthly as stated in GALL. A review of Ginna quarterly fire door walkdown operating experience indicated that these issues have not been of concern.

During the AMP audit interview, Ginna AMP program owners confirmed that Ginna is continuing to test the diesel-driven fire pumps. The Ginna AMP states, "Periodic testing of the motor and diesel-driven fire pumps ensures that adequate flow of firewater is supplied and that there is no degradation of diesel fuel lines to the diesel fire pump," and, "Two redundant, full capacity fire pumps, one electric-motor driven and one diesel driven, with independent power supplies and controls are provided. The fuel supply tank for the diesel driven fire pump contains an eight hour minimum fuel supply."

The Ginna STP-O-13 states, "Performance test is performed monthly to verify the standby operability of the diesel engine-driven and electric motor-drive fire pumps." It also states, "Periodic testing of the fire pumps provided data and trending to justify replacement of Diesel fire pump engine in 1994 and replacement of both pump assemblies in 2002 and 2003 to address wear-related impeller and column pipe issue." During the audit, it was reported that impeller wear of the electric-motor driven fire pump has been observed at Ginna.

Additional equipment was added to the list of safe-shutdown components to account for the effects of increased decay heat due to the Ginna power upgrade. Ginna stated that there was no impact of EPU on the fire protection AMP, and the FPP will continue to meet the requirements of 10 CFR 50.48, Appendix R to 10 CFR 50, and general design criteria (GDCs) 3 and 5 following implementation of the ~~proposed~~ EPU.

The reactor coolant pump (RCP) oil collection tank was also discussed in the audit, and no issue was noted. Overall, no major concerns were identified in Ginna's FP AMP during the audit. The AMP has numerous detailed plant inspection and testing procedures in place and they appear effective.

The NMP-1 AMP owners pointed out that some fire barrier penetration seals (i.e., silicone foam, elastomer, Kaowool, and flamastic) were damaged. Flamastic sealant, when subjected to vibration and thermal cycling, can become brittle and after heating and can swell and crack. Routine inspection of these penetrations has been effective in repairing defects prior to loss of functionality.

~~In the health report, the *Fire Detection and Fire Suppression System Health Report* (7/1/2011 – 9/30/2011), NMP-1 determined that performance of fire protection and fire water systems was unacceptable in this period. The report stated that critical issues include:~~

- ~~Degradation of CO_2 system.~~
- ~~Poor reliability of fire panels, detection systems and Drazetz recorder.~~
- ~~Diesel fire pump (DFP) piston ring wear margins issues.~~
- ~~Smoke removal dampers have high failure rates due to binding. NMP-1 stated that dampers are a Safe Air Model 700 that are obsolete and have a history of repetitive failures (bindings). NMP-1 plans to upgrade the dampers to new design.~~

~~NMP-1 pointed out that aging and obsolescence is an issue for the fire panels, and the dampers failing to stroke was most likely caused by age-related degradation of the damper actuators. All the dampers are early 1980 vintage equipment. In CR-2005-001483, smoke removal dampers were observed to not open under any circumstances.~~

Comment [MRF40]: None of these 4 issues identified in the System Health Report have anything to do with aging management and aging issues of components within scope of LR. The CO_2 system issue is specific to operations issues relative to personnel safety upon actuation; the 2nd issue is specific to instrumentation (active) anomalies for panels that are scheduled to be replaced, the 3rd is specific to the diesel engine (active) which was replaced in 2011, and the 4th is specific to dampers (active). In the subsequent paragraph, as stated above, fire panels and dampers are active components and not within scope of LR.

Based on review of inspection procedures and discussion with AMP program owner in the audit, the AMP was found to be effective in monitoring loss of material and cracking via visual inspection and testing of penetration seals, fire barrier walls, ceilings and floors, cable coatings and fire-rated doors to verify that these components continue to perform their intended functions. Visual inspections of fire barriers and penetrations, which include all sealing devices, are documented. Aging effects were observed and documented associated with flamastic sealants, detectors, and damper actuators.

2.3.26 XI.M27 Fire Water System

Ginna implements this program through its "Fire Water System" AMP B2.1.14. This AMP manages aging effects including loss of material due to general, pitting, crevice, and galvanic corrosion, microbiologically influenced corrosion (MIC), and biofouling within the fire water system (FWS) and associated components (sprinklers, nozzles, fittings, hydrants, hose stations, standpipes, fire water storage tank, fire booster pump, etc.). The Ginna LRA AMP contains the following exceptions to GALL, Rev. 0: (i) The GALL Report states that sprinkler systems are to be inspected once every refueling outage, whereas sprinkler system headers and spray heads are inspected every 2 years at Ginna, (ii) GALL states that fire hydrant flow tests are to be performed annually, whereas, fire hydrants are flushed annually at Ginna by opening each hydrant fully and verifying (qualitatively) adequate flow. Flow test and performance trending data are collected every 3 years and the frequency is supported by plant-specific OE (DA-ME-97-081) and industry practice. In Appendix A of the SER, Ginna committed to implement the following items prior to the PEO:

(1) Replace or test a representative sample of fire water system sprinklers that have been in service for up to 50 years.
(2) Define selection criteria, sample size, and periodicity of inspections for fire system piping.
(3) Add fire service water (SW) booster pump and associated valves and piping back to the service water system into the scope of license renewal.

Comment [MRF41]: Item (1) did not occur before the PEO and is not scheduled to occur for several years yet; so, this needs to be reworded.

~~Ginna site procedure S-CTP-V632, "Sampling and Analysis of Water Systems for Bacteria," is credited with managing loss of material due to microbiological activity. The procedure provides for sampling and analysis of raw water systems for the presence of bacteria. In addition, as presented in Sections A1.1.18 and B2.1.17 of the original LRA, the Fire Water System Program was to be enhanced prior to the PEO to add specific requirements for periodic sampling of water-based fire protection systems.~~

Comment [MRF42]: This is not a Ginna Procedure, it is a NMP procedure and it is addressed below, along with the LR Commitments, in the NMP discussions.

Ginna performs 3-year inspections on fire water storage tanks. During the 2004 inspection, 32 areas of coating failures were found in the interior of the fire storage water tank. There are 16 FWS-related CRs from 2008 to 2010 in the trending documents. Most of the CRs relate to excessive corrosion on fire piping~~s~~, valves, vent, drain, and bolts, and selective leaching of valves. ~~The CAP is based on replacement and an inspection every 5 years.~~ The ~~CAP~~ corrective actions for CR-2009-003214 included adding inspection results to the FWS corrosion-monitoring program for tracking periodic fire water piping inspections.

Comment [MRF43]: This statement seemingly refers to the Corrective Action Program (CAP); however, there is no context for where in the CAP it comes from and it, therefore, makes no sense. It should be removed. The following sentence does reference a specific CR and does make sense.

The Ginna FWS AMP includes the management of aging effects in buried cast iron piping and fittings. External surfaces of buried piping are visually examined during maintenance activities (opportunistic inspection) conducted during performance tests. No age-related degradation has been detected from inspections performed to date. Overall, the Ginna's Fire Water AMP appears effective. Aging effects were found by this AMP and were documented in the CRs.

NMP-1 implements this program through its existing "Fire Water System Program" AMP B2.1.17. The tprogram activities include periodic maintenance, testing, and inspection of system piping and components containing water (e.g., sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes) in accordance with National Fire Protection Association (NFPA) codes and standards. Since Lake Ontario is the source of water, water storage tanks are not in the scope of the AMP. Site procedure S-CTP-V632, "Sampling and Analysis of Water Systems for Bacteria," is credited with managing loss of material due to microbiological activity with sampling and analysis of raw water systems for the presence of bacteria. Flow tests of underground main header piping are conducted every 5 years. Hydrants are opened up at the far corners of the plant and flow rates compared.

NMP-1 committed to implement the following items prior to the PEO in ~~the SER Appendix A~~LRA Section A.1.4:

Comment [MRF44]: NMP made commitments in the LRA since it didn't write the SER.

(1) Incorporate inspections to detect and manage loss of material due to corrosion into existing periodic test procedures.
(2) Specify periodic component inspections to verify that loss of material is being managed.
(3) Add procedural guidance for performing visual inspections to monitor internal corrosion and detect biofouling.
(4) Add requirements to periodically check the water-based fire protection systems for microbiological contamination.
(5) Measure fire protection system piping wall thickness using non-intrusive techniques (volumetric testing) to detect loss of material due to corrosion.
(6) Establish an appropriate means of recording, evaluating, reviewing, and trending the results of visual inspections and volumetric testing.
(7) Define acceptance criteria for visual inspections and volumetric testing.
(8) Develop new procedures and preventive maintenance tasks to implement sprinkler head replacements and/or inspections to satisfy NFPA 25, Section 5.3.1.

It was noted during the NMP-1 audit that tuberculation was observed in fire water branch piping during the flow tests. The tuberculation found in the NMP-1 fire water system appears to be a new aging mechanism in the fire water system. The licensee indicated that there are repetitive observations of tuberculation and that this is an ongoing issue. Other than tuberculation, degradation reported in CRs in recent years includes:

- Obstructions in fire water piping due to corrosion products or lake water silt (one CR in 2005).
- Through-wall leaks of fire protection piping (4 CRs in 2002-2004).
- UT readings of fire protection piping below minimum wall thickness (7 CRs).

In the fire water pressure maintenance subsystem, which pumps oxygenated city water, NMP-1 replaced CS piping with SS, and the diameter of the SS piping was increased. What was previously 1.5-in.-diameter CS piping was replaced with 2-in.-SS piping. Overall, the Fire Water System AMP at NMP-1 appears to be effective, and aging effects are being found and documented.

2.3.27 XI.M29 Above Ground Metallic Tanks

Ginna implements this program through its "Aboveground Carbon Steel Tanks" AMP B2.1.1. The program consists of periodic visual examination by system engineers and a one-time limited UT examination of tank bottom. The AMP is written to conform to Rev. 0 of the GALL Report and does not meet GALL, Rev. 2 that recommends follow-up UT every five years. Ginna performed a one-time limited UT inspection of the tank bottoms prior to PEO in 2004 as indicated in the SER and LRA. It was noted in the audit that the AMP and associated implementing procedures do not address any follow-up examination of the tank bottom plates even though one-time UT measurements of the tanks in 2004 prior to PEO indicated loss of thickness of up to 20 percent due to corrosion. The tank bottom plates were not repaired or coated at that time and no follow up inspections scheduled. The AMP owner stated that they are scheduling follow up UT inspections every six years. Follow-up UT inspection of condensate tanks that was scheduled for May 30, 2011, was postponed.

Comment [MRF45]: It should be noted that the wall loss was due to the failed coatings on the accessible ID surfaces and was found during visual inspections. The UT is for the underside inaccessible portion of the tank bottom where it is in contact with the concrete pedestal. So, the fact does remain that the coating was not repaired; however, the UT indicated that the bottom side of the carbon steel tank bottom against the concrete is not displaying aging.

GALL AMP XI. M29 "Aboveground Carbon Steel Tanks" is not applicable to NMP-1. NMP-1 credits the existing plant-specific programs, "Preventive Maintenance Program" AMP B2.1.32 and "System Walkdown Program" AMP B2.1.33 for managing aging effects of aboveground metallic tanks. The B2.1.32 AMP ~~program~~ provides for performance of various maintenance activities on a specified frequency based on vendor recommendations and operating experience. The scope of the program includes, but is not limited to, valve bodies, heat exchangers, expansion joints, tanks, ductwork, fan/blower housings, dampers, and pump casings. The aging effects of concern are detected by visual inspection and NDE examination of components for evidence of defects and age-related degradation. Under this program, it no adverse degradation of the aboveground metallic tanks has been detected. The audit found that the overall program appears to provide a reasonable framework for managing aging in the SSCs to which it is applied.

The Systems Walkdown Program at NMP-1 manages aging effects for accessible external surfaces of selected SSCs within the scope of license renewal~~ at NMP-1~~. The specific aging effect of concern is loss of material from external surfaces of pumps, valves, piping, bolts, heat exchangers, tanks, expansion joints, electrical penetrations, electrical enclosures and cabinets, HVAC components, and other carbon steel components. Program activities include system engineer walkdowns (i.e., field evaluations of system components to assess system performance and material condition), evaluation of inspection results, and appropriate corrective actions. The frequency of inspections is at least once per refuel cycle for each structure and system. The audit found that the program appears to provide a satisfactory framework for managing the types of time-related degradation for which it was designed. .

2.3.28 XI.M30 Fuel Oil Chemistry

This program is implemented at Ginna through its "Fuel Oil Chemistry" AMP B2.1.16. The Ginna AMP lists no enhancements to GALL, Rev. 0, but lists two exceptions, namely Ginna: (1) does not add biocides, stabilizers, or corrosion inhibitors to the fuel oil to mitigate corrosion; and (2) does not sample for particles in accordance with the modified ASTM D2276 test procedure. Particulate testing has subsequently been added the program, thereby eliminating this second exception.

NMP-1 implements this program through its "Fuel Oil Chemistry Program" AMP B2.1.18. This AMP takes the following exceptions to GALL, Rev. 0: (i) NMP-1 ~~and NMP-2~~ uses only the guidance given in ASTM D1796 rather than in both ASTM D 1796 and ASTM D2709 to determine the concentration of water and sediment in the diesel fuel oil tanks (these standards are applicable to fuel oils of different viscosities, and ASTM D 1796 is the standard that applies to the diesel fuel used at NMP-1~~ and NMP-2~~); (ii) NMP-1 ~~and NMP-2~~ takes an exception to using the modified ASTM D 2276, Method A, which specifies a pore size of 3.0 µm, and NMP-1 ~~and NMP-2~~ uses a filter with a pore size of 0.8 µm, as specified in ASTM D 2276; (iii) NMP-1 ~~and NMP-2~~ takes an exception to multilevel sampling in the diesel fuel oil tanks (the physical configuration of the fuel oil tanks does not allow a representative fuel oil sample to be taken at multiple levels); and (iv) NMP-1 ~~and NMP-2~~ takes an exception to periodically sampling the diesel fuel oil day tanks. These small tanks do not have a provision for sampling. Per Technical Specification Surveillance testing, the lower portion of the diesel fuel oil is drained quarterly in NMP-1~~, and monthly in NMP-2~~.

In addition, the following enhancements are noted in the NMP-1 AMP: (i) incorporate periodic tests for the presence of microbiological organisms at NMP-1; (ii) provide guidelines for the appropriate use of biocides, corrosion inhibitors, and/or fuel stabilizers to maintain fuel oil quality; ~~(iii) add a requirement to sample the NMP-2 diesel fuel oil storage tanks for water and sediment at least quarterly per ASTM standard;~~ (~~iv~~iii) add requirements to periodically inspect the interior surfaces of the NMP-1 emergency diesel fuel oil tanks and diesel fire pump fuel oil day tank, ~~and the NMP-2 fuel oil tanks~~ for evidence of significant degradation, including a specific requirement that the tank bottom thickness be determined; (~~v~~iv) add a requirement for quarterly trending of particulate contamination analysis results; and (vi) ensure acceptance criteria are specified in the implementing procedures for the applicable indications of potential degradation.

The Ginna LRA states that the underground diesel fuel storage tanks have been drained and inspected annually until 1993 and annual pressure tests have been performed, with internal inspections performed on a 10-year frequency. No biological activity or evidence of degradation of the interior surfaces of either storage tank has ever been observed.

At NMP-1, the emergency diesel generator and diesel fire pump storage tanks are sampled and analyzed on a monthly or quarterly basis for water and sediment, and particulate contamination. The results are

Comment [MRF46]: See Comment MRF 3

Comment [MRF47]: See Comment MRF 3

Comment [MRF48]: See Comment MRF 3

Comment [MRF49]: See Comment MRF 3

Comment [MRF50]: See Comment MRF 3

Comment [MRF51]: See Comment MRF 3

Comment [MRF52]: See Comment MRF 3

Comment [MRF53]: See Comment MRF 3

Comment [MRF54]: See Comment MRF 3

Comment [MRF55]: This is true; however, the Preventive Maintenance Program Repetitive Tasks actually have a periodicity of every 8 years.

evaluated and included in a quarterly trending program. Additional fuel parameters that are periodically analyzed include American Petroleum Institute specific gravity, flash point, sulfur content, and carbon residue. Every ten years (or sooner if UT thickness measurements indicate an adverse trend), each fuel oil storage tank is subjected to a condition inspection. An aging management inspection is performed which includes a structured visual inspection for loss of material due to pitting, cracking, crevice corrosion, galvanic corrosion, general corrosion, and MIC. UT examinations are also completed of the tank bottoms to determine wall thickness.

The NMP-1 LRA states that a review of plant-specific OpE revealed several incidents where contaminants (e.g., water, particulate) were detected through Fuel Oil Chemistry Program examinations. Numerous water and sediment analyses performed over a long operating period, detected conditions that did not meet plant specifications. In each case, appropriate actions were taken. These actions included increased monitoring, backup samples, contamination removal, and tank cleaning. However, there have been no instances of fuel oil system component failures at NMP-1 attributed to contamination. During the present audit, the NMP-1 personnel stated that two UT inspections of the fuel oil tanks performed at found regions where the local thickness due to pitting was less than the acceptance criterion of 0.3125 in., and engineering evaluations were performed to verify the structural integrity of the tank. It was determined that the affected tank did not require repair or replacement.

Comment [MRF56]: This sentence needs to be re-written. It is not grammatically correct.

2.3.29 XI.M31 Reactor Vessel Surveillance

This program is implemented at Ginna through its "Reactor Vessel Surveillance" AMP B2.1.28. The Ginna AMP lists no exceptions or enhancements to GALL, Rev. 0; but, during its LR audit, the NRC identified an apparent exception to GALL guidance related to the schedule for withdrawing surveillance capsules for testing. After additional clarification, the staff found this exception acceptable.

NMP-1 implements this program through its "Reactor Vessel Surveillance Program" AMP B2.1.19. The NMP Reactor Vessel Surveillance Program takes no exceptions to GALL, Rev. 0, but adds the following enhancements: (i) incorporate the requirements and elements of the integrated surveillance program (ISP), as documented in BWRVIP-116 and approved by NRC, or an NRC approved plant-specific program, into the Reactor Vessel Surveillance Program, and include a requirement that if NMP Nuclear Station surveillance capsules are tested, the tested specimens will be stored in lieu of optional disposal; and (ii) project analyses of upper shelf energy and pressure-temperature limits to 60 years using methods prescribed by Regulatory Guide (RG) 1.99, Rev. 2, and include the applicable bounds of the data, such as operating temperature and neutron fluence. In addition, the NRC staff also required the following license condition: "Implementation of the most recent staff-approved version of the BWRVIP ISP as the method to demonstrate compliance with the requirements of 10 CFR Part 50, Appendix H. Any changes to the BWRVIP ISP capsule withdrawal schedule must be submitted for NRC staff review and approval. Any changes to the BWRVIP ISP capsule withdrawal schedule, which affects the time of withdrawal of any surveillance capsules must be incorporated into the licensing basis. If any surveillance capsules are removed without the intent to test them, these capsules must be stored in manner which maintains them in a condition which would support re-insertion into the reactor pressure vessel, if necessary."

The Ginna SER Appendix A includes Commitment 38 under which the licensee agreed to the following: (1) withdraw a surveillance capsule in Spring 2005 and submit a test report of the results within 1 year; and (2) withdraw the last surveillance capsule shortly after accumulating fluence equivalent to 80 years of operation. However, in a letter dated May 29, 2009 (supplemented Feb. 18, 2010), the licensee submitted WCAP-17036-NP, Rev. 0, "Analysis of Capsule N from the R. E. Ginna Reactor Vessel Radiation Surveillance Program," to the NRC. Note (3) of Table 7-1, in WCAP-17036-NP states that Capsule P should be removed at about 33.9 effective full power year (EFPY) to fulfill the commitment ~~of [28]~~ to remove the capsule shortly after it accumulates a fluence equivalent to 80 years of operation ~~(reference [28] refers to the NRC SER for Ginna LR). However, WCAP-17036-NP does not clearly address how the licensee has been keeping track of the implantation schedule for the LR commitments, especially the first item of LR Commitment 38. In fact, WCAP-17036-NP does not provide a specific~~

Comment [MRF57]: The rest of the document to this point does not refer to Reference numbers; so, it is inconsistent to do it here and it adds no value.

~~reference to LR Commitment 38, even though the major topic of the WCAP report is the test and analysis results for Capsule N, which is, in turn, directly relates to LR Commitment 38.~~

Section 4.0 of the Ginna Program Basis Document (PBD), Rev. 4, states that the licensee's reactor vessel surveillance program includes the following subprograms: (1) surveillance capsule insertion, withdrawal and evaluation; (2) fluence and uncertainty calculations; (3) monitoring of effective full-power years; (4) development of pressure-temperature limit curves; and (5) calculation and monitoring of low-temperature overpressure protection (LTOP). , it was noted during the audit that no updates have been made to the PBD since April 2009.

~~The Ginna surveillance program states that the accumulated neutron fluence is monitored by measurements of the irradiated material specimens. However, it was noted in the audit that the program does not clearly address how the licensee's program benchmarks the neutron fluence calculations using the neutron dosimeters. In addition, the program does not clearly describe how it uses the data of the ongoing neutron dosimeter measurements to validate the previous calculations for fluence projections. Furthermore, the program does not clearly describe how the cold leg temperatures, which may affect the degree of reactor vessel irradiation embrittlement, are collected and analyzed in the reactor vessel surveillance program.~~

In the Ginna LRA, the licensee indicated that when a capsule is removed, the neutron dosimetry data from the withdrawn capsules are evaluated to validate the fluence calculation. In addition, the PBD indicates that monitoring of EFPY is necessary to enable a projection of the fluence of the reactor vessel belt-line material as a function of time. The PBD indicates that PT curves are normally developed based on a particular projection of EFPY, beyond which they are not valid. The PBD also indicates that EFPY calculations are performed at Ginna Station by using the Daily Reactor Power Log. ~~During the audit, the licensee indicated that it has no formal procedure for the projection of the fluence; however, the engineering staff performs the projections using the power data. Furthermore, the licensee (or the PBD) did not clearly address how frequently the ongoing dosimetry data are used to validate the flux/fluence calculations and projections, especially between the refueling outages when capsules are withdrawn.~~

Ginna indicated that the last capsule (sixth capsule P) is expected to be withdrawn in about 2018 after exposure to the 80-year-operation fluence level projected for the reactor vessel. It is noted that if Ginna were to continue its operation for the SLR period, it would enter the second license renewal period in 2029, which means that if no additional capsule is reconstituted, Ginna would operate for additional 30 years without a capsule in the reactor vessel. In the broader picture, extended operation beyond 60 years increases the likelihood that a number of licensees will exhaust their supply of surveillance capsules in the reactor vessel. This means that they will increasingly be forced to rely on the alternatives given in GALL AMP XI.M31.

As a part of its reactor vessel surveillance AMP, NMP-1 is participating in an ISP as described in BWRVIP-116. However, it was noted during the audit that the ISP provisions of BWRVIP-116 and BWRVIP-86-A have recently been merged into BWRVIP-86, Rev. 1, which was approved by the NRC in October 2011 and it supersedes BWRVIP-116. During the audit interview, NMP-1 personnel indicated that their ISP is being updated to conform to the new guidance in BWRVIP-86, Rev. 1.

2.3.30 XI.M32 One-Time Inspection

This program ~~is~~ was implemented at Ginna through its "One-Time Inspection" AMP B2.1.21, which identifies no exceptions or enhancements to GALL, Rev. 0. NMP-1 implements this program through its "One-Time Inspection Program" AMP B2.1.20 and again identifies no exceptions or enhancements to GALL, Rev. 0. However, the NMP-1 LRA included a commitment to develop and implement the One-Time Inspection Program prior to the period of extended operation that also includes the attributes for a selective Leaching of Materials Program. Both the Ginna and NMP-1 AMPs were new programs to be implemented prior to entering the period of extended operation.

Comment [MRF58]: The WCAP would not refer to a Ginna LR Commitment. It is recommended that this sentence, and the next to last paragraph of this section, be re-written considering the following information: As a function of the industry interest in SLR and the initiative by EPRI to determine a strategy for capsule surveillance relative to the possibility of plants' operation to at least 80 years, further capsule activity is on hold at both Ginna and NMP1 until a strategy is developed. Further, both Ginna and NMP1, as a function of the DOE/EPRI/CENG Nuclear Plant Life Extension Demonstration Project, are working with DOE and EPRI to optimize the use of their remaining capsules. As a function of this collaboration, Ginna is looking at the re-use of broken Charpy specimens from previously tested capsules. These specimen halves have been retained by Westinghouse since the withdrawal of the 1st capsule. Westinghouse has already been contacted about their possible re-use.

Comment [MRF59]: This is all done by the reactor vendor; so, there is no plant documentation that defines the vendor's process.

Comment [MRF60]: Again, there are no site procedures written to establish vendor calculation methodology.

It was noted during the audits at both Ginna and NMP-1 that GALL, Rev. 2 now treats the inspection of small-bore (<4 in.) piping under a separate AMP XI.M35. However, the Ginna and NMP-1 AMPs on one-time inspection, which were prepared under GALL, Rev. 0 guidance, cover all piping diameters.

The Regional IP 71003 inspections (IRs 244/2009-007 and 244/2009-009) specifically evaluated the results of the Ginna One-Time Inspection Program. The inspection report concluded that the One-Time Inspection Program activities were appropriately completed.

During the Ginna audit, an issue was raised about SCC of SS in an environment less than 140°F. The site identified multiple examples for thin-walled piping (schedule 10) that showed sensitization of the weld HAZ. During discussions, licensee personnel said a new OpE document was not considered, since this issue is specifically addressed in NRC IN 2011-04, "Contaminants and Stagnant Conditions Affecting Stress Corrosion Cracking in Stainless Steel Piping in Pressurized Water Reactors." It was noted that, while this does not specifically impact the One-Time Inspection Program, there may be a need to include an AMR line item in GALL to address this issue.

Comment [MRF61]: There are 3 different issues here that have been confused and not reported correctly. The 3 issues are as follows:

1) SCC in an environment of <140°F – this was caused by a contaminant, chlorides, not an AERM identified in the AMRR. Further, this was an isolated case where a contaminant wound up accumulating in a stagnant area.

2) Regarding the multiple examples for thin wall Schedule 10 piping showing sensitization, this piping was >140°F, and has been replaced. Also, there is a supplemental Thin-Wall Program to ISI that inspects the locations where this piping was replaced.

3) NRC IN 2011-04 is an OD surface issue where stagnant conditions could exist from condensate between the piping's OD surface and pipe supports. The OTI Small Bore Class 1 AMP focused on ID initiated SCC, where IWB exempts this piping from volumetric examinations. This is not an AERM. This is an event driven condition that can occur due to a nearby pipe leak, or out of normal condition that may cause condensate under a clamp. Most plants responded to this by recommendations given, such as providing awareness during inspection such as in VT-2 for Leakage Procedures. This condition is not within the scope of an OTI AMP.

It was noted during the audits that the One-Time Inspection Program provides an acceptable means to verify the effectiveness of other AMPs where the environment in the PEO is expected to be equivalent to that in the prior 40 years and for which no aging effects have been observed. The program description states that this AMP is applicable to situations where: (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 same criteria for the applicability of the One-Time Inspection Program may be applied to operation beyond 60 years.

2.3.31 XI.M33 Selective Leaching

Ginna implements this program through its "Selective Leaching" AMP B2.1.29. The Ginna AMP utilizes visual inspections performed under their "Periodic Surveillance/Preventive Maintenance" Program (AMP B2.1.23), and their "One-Time Inspection" Program (AMP B2.1.21), to determine if selective leaching is occurring in susceptible components. The program claims consistency with GALL, Rev. 0, with the exception that hardness testing is not performed as part of the program. Instead, the feasibility of performing hardness tests and the value of hardness test data ~~will be~~is assessed on a component-specific basis.

The NMP-1 "Selective Leaching Program" AMP B2.1.21 was identified as a new program in the LRA and ~~is~~ was implemented through ~~its~~ the One-Time Inspection Program. The NMP-1 LRA ~~includes~~ included a commitment to develop and implement the One-Time Inspection Program prior to the PEO that also ~~includes~~ included the attributes for a ~~selective~~ Selective Leaching of Materials Program.

Inspections at Ginna positively identified one example of selective leaching in the gray cast iron drain plug of an auxiliary FW pump outboard bearing cooler. Evidence of degradation was also found on five other pumps but could not be definitely determined to be a result of selective leaching. Possible selective leaching was also found on multimatic valves on the underside of the clapper. As a result of these observations and in conformance with GALL XI.M33, a plant-specific program has been developed whereby the components in question are inspected every quarter under the Ginna Preventive Surveillance and Periodic Maintenance Program. If follow-on destructive examinations verify selective leaching in one of the suspect pumps, all six pumps will be replaced with cast steel pumps.

The PBD, Rev. 0, for NMP-1 provides considerable detail as to the SSCs, materials, and environments to which the program applies, but it was not clear on inspection techniques. For example, in Table 5.0-1, GALL Consistency Review, of the PBD, the assessment of consistency under "Parameters Monitored/Inspected" states, "the program will provide direction for visual inspection of susceptible, internal SSC surfaces." It further states, "field hardness testing due to the capabilities of portable equipment and efforts necessary to qualify material specific test procedures is not planned on site."

However, under "Detection of Aging Effects" of the same table, the assessment of consistency states, "where practical, field hardness testing will be performed in lieu of off-site testing." In the audit interview, the licensee clarified that field hardness testing is performed where practical. Attachment 2, "Operating Experience Review," to the PBD also makes it clear the field hardness testing has been performed at NMP in the past for other purposes.

Comment [MRF62]: Because of the size and geometry of the portable tester, there are limited locations where it is able to be utilized. That is why there is the disparity. The wording under "Parameters Monitored/Inspected" did not make that clear, unfortunately. It was used where it was able to be used.

NMP-1 established four material/environment groups, i.e., susceptible copper alloys, and gray cast iron in treated and raw water, comprising over 340 components. They inspected 25 copper alloy and 29 gray cast iron for 54 components. The samples were selected randomly following EPRI guidance on an appropriate sample size. No selective leaching was detected in this inspection, though condition reports were written for other conditions such as MIC and fouling. One destructive evaluation was conducted later on a copper alloy component, which determined that no leaching was present. However, the component was found to contain less than 15 percent zinc and was therefore not susceptible. Based on this destructive evaluation, 12 other copper alloy samples sampled as described above were determined to be non-susceptible. Removing these from the sample population of 54 components leaves a total of 42, which still constitutes a thorough evaluation of selective leaching.

2.3.32 XI.M35 One-Time Inspection of ASME Code Class 1 Small-Bore Piping

The Ginna and NMP-1 LRAs were prepared under GALL, Rev. 0 guidance and do not include a separate AMP for the inspection of Class 1 small-bore piping. The Ginna LRA manages the aging of small-bore piping through its One-Time Inspection Program and its Water Chemistry Control Program. Similarly, the NMP LRA manages this aging effect through its One-Time Inspection, Water Chemistry Control, and ASME Section XI ISI Programs. Therefore, this AMP was not reviewed during the audits.

2.3.33 XI.M36 External Surfaces Monitoring of Mechanical Components

The license renewal process for both Ginna and NMP-1 was carried out under GALL, Rev. 0, which did not include this AMP but instead called for a plant-specific program. The plant-specific AMP applied at Ginna was the "System Monitoring" Program AMP B2.1.33, and that at NMP-1 was the "Systems Walkdown Program" AMP B2.1.33. The Ginna Systems Monitoring Program does not state any exceptions or enhancements to GALL, Rev. 0, nor are any commitments identified. The NMP-1 Systems Walkdown Program takes no exceptions to GALL, Rev. 0, but it does identify two enhancements, as follows:

(1) Train all personnel performing inspections in the Systems Walkdown Program to ensure that age-related degradation is properly identified and incorporate this training into the site-training program.

(2) Specify acceptance criteria for visual inspections to ensure aging-related degradation is properly identified and corrected.

At Ginna, quarterly walkdowns are conducted for all accessible systems. Walkdowns for systems within containment are conducted at every refueling outage and during any shutdown opportunity. The program covers the RCS, Safety Injection, containment spray, residual heat removal (RHR), chemical volume and control system (CVCS), CCW, SFP, Cooling and Fuel Storage, Main and Auxiliary Steam System, Feedwater and Condensate System, Auxiliary Steam System, Service Water System, Fire Protection System, and others. The purpose of the AMP is to monitor and assess, primarily through visual examination, the condition of the external surfaces of systems, structures, and components in the scope of license renewal, including polymeric materials. Based on discussions with the Ginna personnel during the audit and the CRs made available, the program appears to be primarily concerned with the visual detection of leakage, rust and corrosion, and coating degradation on the external surfaces of accessible components.

There were a large number of findings at Ginna during the first quarterly report for trending corrective action reports, but the number has declined significantly in the following quarterly reports and semiannual trending reports. However, Ginna does not count corrective action reports if the condition has been previously observed and reported but not corrected. Their most predominant aging effect has been boric acid corrosion.

The Systems Walkdown Program at NMP-1 manages aging effects for accessible external surfaces of a variety of systems and components within the scope of license renewal through visual inspections that are performed at least every two years in conjunction with the plant's refueling cycle. For components accessible during operation, inspections are performed more frequently, apparently on a case-by-case basis. During the audit interview, NMP-1 personnel emphasized that the program involves visual inspection only and does not include, for example, manual probing and manipulation of elastomers or any other kinds of hands-on inspections. The inspectors follow pre-defined checklists, and visual inspections are enhanced where necessary using supplemental illumination, hand-held magnifiers, and binoculars. Inspectors do not climb up on components or use ladders during inspection. Where components are not accessible because of mechanical interference or high radiation fields, remote cameras are sometimes used. The acquisition of a robotic camera is under consideration, but there are concerns that, should it become radioactively contaminated, the utility of this costly system would become greatly limited. The licensee stated that, for most inaccessible components, the ~~stated~~ potential for the presence of degradation is inferred from observations on similar accessible components operating under the same environment.

The sort of degradation observed to date at NMP-1 has been relatively minor and is limited primarily to modest surface rust and corrosion and occasional small leaks. The licensee stated that degradation does not appear to be accelerating with time but is more or less steady state, though longer-term extended operation is needed to more accurately assess this trend. In one case, extensive rusting observed on the external surfaces of piping through visual inspection was followed up with extensive UT examinations to verify that it was nothing more than a surface effect.

2.3.34 XI.M37 Flux Thimble Tube Inspection

The GALL Report (NUREG-1801) AMP XI.M37 "Flux Thimble Tube Inspection" is not applicable to NMP-1 plant since it is a BWR. This program is implemented at Ginna as a plant-specific "Thimble Tubes Inspection" AMP B2.1.36 in its LRA. The implementation at Ginna uses NRC Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors," July 26, 1988, as its basis, and it includes a license renewal Commitment (#39, Appendix A of SER Report NUREG-1786) to include inspections for SCC and wear during each outage, since SCC or intergranular attack (IGA) were previously detected in certain regions of thimble tube.

GALL, Rev. 0 did not include this program, and Revs. 1 and 2 of GALL address only the wear loss of the tube wall as the aging effect. Ginna's implementation and OpE to inspect for SCC/IGA is thus an enhancement to GALL AMP XI.M37. During the Ginna audit, the staff confirmed this OpE and that the licensee's corrective action of periodic flushing of the thimble-tube-to-guide-tube annuli was an appropriate response to address this aging effect in addition to the tube wear.

The Ginna audit also determined that the licensee had manufactured a notch standard specimen to provide a threshold level of detection for simulated cracks for use in inspections under its Commitment #39 and that the inspections were performed as required with corrective action based on SCC detection (without regard to sizing). The staff considered these licensee actions and program implementation to be effective in managing this aging effect under its AMP B2.1.36. However, the staff noted that, regarding SCC detection, the licensee had determined that its Eddy Current Testing system qualification did not meet the level of sizing capability originally addressed in its response to the Open Item of the SER. However, through its internal commitment change process, the licensee determined that this finding did not require further communication with the NRC. Therefore, the staff identified a potential need for more detailed guidance on how a licensee should evaluate and communicate such implementation findings with the NRC.

Comment [MRF63]: The industry commitment change process documented in NEI 99-04, and the threshold level for NRC notification, is NRC endorsed.

With regard to the wall loss due to wear as the aging effect managed under this AMP, the Ginna audit review of licensee's inspection results described in its program basis documents (1999 -2008) indicated that the licensee had replaced 5 thimble tubes in 4 locations and that all thimble tubes show acceptable wear levels against the acceptance criteria. This is considered indicative of the AMP's effectiveness in identifying and managing this aging degradation process.

Comment [MRF64]: During the 2011 RFO, all 36 Thimble Tubes, as well as seal table subcomponents, were replaced. The previous SS304 tubes were replaced with more SCC resistant SS316 and the portions of the tubes that were susceptible to wear were chromed to mitigate wear. With the completion of this modification, a commitment change was processed to change the Thimble Tube inspection frequency, beginning in 2014, to every 3rd RFO instead of every RFO.

2.3.35 XI.M38 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components

The license renewal process for both Ginna and NMP-1 was carried out under GALL, Rev. 0, which did not include this AMP but instead called for a plant-specific program. The plant-specific AMP applied at Ginna was the "Periodic Surveillance and Preventive Maintenance" Program AMP B2.1.23, and that at NMP-1 was the "Preventive Maintenance Program" AMP B2.1.32. The Ginna Periodic Surveillance and Preventive Maintenance Program lists no exceptions to GALL, but it states under Program Elements 3 ("Parameters Monitored/Inspected"), 4 ("Detection of Aging Effects"), and 6 ("Acceptance Criteria") that "Operations, maintenance, and surveillance test procedures and task descriptions will be enhanced to provide explicit guidance on detection of applicable aging effects and assessment of degradation." The NMP-1 Preventive Maintenance Program takes no exceptions to GALL, Rev. 0, but it identifies the following enhancements:

(1) Expand the Part Monitoring Program to encompass activities for certain additional components, identified as requiring aging management, and explicitly define the aging management attributes, including the systems and the component types/commodities included in the program.
(2) Specifically list those activities credited for aging management.
(3) Specifically list parameters monitored.
(4) Specifically list the aging effects detected.
(5) Establish a requirement that inspection data be monitored and trended.
(6) Establish detailed parameter-specific acceptance criteria.

During the license renewal process, NMP-1 committed to making enhancements to the Preventive Maintenance Program to revise existing procedures. These enhancements would provide the level of detail and specificity needed for Staff review of the Preventive Maintenance Program. They would affect the main program elements including "Scope of Program," "Preventive Actions," "Parameters Monitored," "Detection of Aging Effects," "Monitoring and Trending," and "Acceptance Criteria." At the request of the NRC staff, these enhancements were to be completed on a schedule of sufficient time for staff review and approval prior to the PEO.

Comment [MRF65]: This is an incorrect statement. See LRA Table A1.4, Commitment 29. That is the LR Commitment cited above. As with most of the Commitments in this table, the schedule for completion was "Prior to Period of Extended Operation." This meant that all of the infrastructure associated with each of these Commitments, including procedure changes/new procedures, PM Task changes/new PM Tasks, etc., had to be implemented and in place by entry into the PEO. This further meant that when NRC Region I came to conduct their IP71003 Phase 2 inspection, this all had to be completed and in place so the Region could verify that the LR Commitments had been met. There was nothing submitted for staff review for any of these Commitments before the IP71003 Phase 2 Inspection. There were only 3 LR Commitments (2, 12, and 22) that required submittals for NRC Staff review by specific dates ahead of PEO entry and the IP71003 Phase 2 inspection.

The Periodic Surveillance and Preventive Maintenance Program at Ginna is an existing plant-specific program that uses visual and volumetric inspections of selected equipment items and components for evidence of aging-related degradation on a specified frequency based on operating experience. Leak inspections of piping and components in selected portions of systems are also performed on selected systems. Eddy current testing of tubing is used for inspecting heat exchangers and coolers within the scope of license renewal. Polymeric materials such as seals, gaskets, flexible collars, expansion joints, rubber boots, etc. in certain ventilation system components are also periodically inspected. This program is most closely to the GALL Internal Surfaces Monitoring Program, but it appears to be a much broader program in that it goes beyond piping and ducting to include visual and volumetric inspections of pumps, heat exchangers, valves, seals, gaskets, and similar components.

The Ginna program has produced a number of condition reports from the inspections, and observations from these reports are fed back to their respective programs. When significant corrosion or other degradation is observed, the inspection frequency is increased. A significant number of pipe replacements have resulted from observations in this program.

The Preventive Maintenance Program at NMP-1 differs from their plant-specific Systems Aging Walkdown Program discussed above in that the Walkdown Program is confined to the visual examinations of accessible external surfaces, whereas the ~~present p~~Preventive Maintenance Program employs a variety of visual and NDE inspection techniques designed to detect both surface and volumetric aging effects. The Program Basis Document for this AMP provides a detailed listing of the systems, components, environments, and aging effects to which this AMP applies and lists in detail the plant specific supporting program implementing documents. PBD Table 5.0-1 the "Parameters Monitored/Inspected" element clarifies that, despite its name, the program encompasses much more that simple preventive maintenance and utilizes a variety of visual and NDE inspection techniques. Inspections are largely performed on a two-year basis as dictated by the NMP-1 refueling cycle, since many of the SSCs managed by this AMP are accessible only during refueling outages

There has been only one significant adverse finding at NMP-1, and that was in a retired/abandoned-in-place component in which the pump casing and connections showed signs of corrosion. The pump is to be disconnected so it will no longer be in the scope of license renewal. Corrosion of some pump coatings has also been observed, and these coatings have been replaced. If similar corrosion is observed on inspections of similar pumps, the inspection sample population size will be increased.

During the NMP-1 audit, the plant owner of the program stated that he maintains a detailed set of spreadsheets through which he tracks any changes with time. The inspection frequency is largely dictated by the plant's two-year refueling cycle, and, as noted above, inspection sample sizes and inspection techniques employed appear to be based on the results of previous inspections and observed trends.

Comment [MRF66]: The same is done by the AMP Owner at Ginna.

2.3.36 XI.M39 Lubricating Oil Analysis

The license renewal process for both Ginna and NMP-1 was carried out under GALL, Rev. 0. That edition of the GALL Report mentions lubricating oil, with contaminants and/or moisture, as a possible operating environment for several components, but it contains no AMP-related to Lubricating Oil Analysis. Consequently, neither the Ginna LRA nor the NMP LRA provides an AMP on Lubricating Oil Analysis. The Ginna LRA mentions the aging management of oil coolers in the auxiliary FW system in contact with contaminated lubricating oil and lists its Periodic Surveillance and Preventive Maintenance Program, as the applicable AMP. The NMP LRA lists a number of components in contact with lubricating oil, but makes no mention of possible contamination and identifies no aging effect.

No audits of AMPs dealing with lubricating oil analysis were conducted at Ginna or NMP-1.

2.3.37 XI.M40 Monitoring of Neutron Absorbing Materials Other than Boraflex

Ginna implements this program through its "Spent Fuel Pool Neutron Absorber Monitoring" AMP B2.1.30, which is similar in scope to the GALL Rev. 2 AMP XI.M40, "Monitoring of Neutron-Absorbing Materials Other Than Boraflex." Ginna uses soluble boron and borated stainless steel for neutron absorption; existing Boraflex in the spent fuel pool is not credited and thus is not age-managed. The Ginna's B2.1.30 AMP program monitors long-term performance of the borated stainless steel (BSS) panels using surveillance coupons comprised of the same material. As stated above, Ginna Station also incorporates boraflex panels in the SFP. However, reliance on the neutron absorption capability of the boraflex panels was discontinued when the NRC approved License Amendment 79 on December 7, 2000.

Ginna's program uses BSS coupons mounted on a surveillance tree in the SFP. These samples are removed for visual examinations for signs of corrosion or blistering, and physical measurements of thickness and weight, for comparison to pre-operational photographs and measurements. Samples are removed, examined and returned to the surveillance tree every 3 refueling outages, by "qualified personnel." The BSS coupon samples have been examined in 2000, 2006, and 2010 and no degradation was found in any ~~evalualted~~ evaluated parameter. The visual observations and quantitative observations have identified no changes from the pre-operational conditions. Ginna has reviewed the NRC Information

Notice 2009-026, "Degradation Of Neutron-Absorbing Materials in the Spent Fuel Pool", and they determined that no changes were needed in the AMP. Overall, the program appears ~~effectve~~ effective and the audit did not find any major issues and no new aging effect was identified for the SLR.

As stated in Section 2.1.21, the NMP-1 spent fuel pool had eight Boraflex racks in its spent fuel pool. Only two racks made of Boraflex currently exist in the NMP-1 spent fuel pool. Two re-rack campaigns were performed in 1999 and 2004, which replaced most of the original Boraflex and non-poison racks with Boral racks. NMP-1 credits its existing "Boraflex Monitoring Program" AMP B2.1.12 for managing aging effects of ~~both Boral and Boraflack~~ Boraflex racks; however, the Boral racks are monitored based on a specific commitment made to the NRC during the licensing of the rack expansion and redesign to the use of Boral. Findings and evaluation of ~~the~~ NMP-1's "Boraflex Monitoring Program" AMP ~~is~~ are contained in Section 2.1.21, XI M22, "Boraflex Monitoring" of this report.

2.3.38 XI.M41 Buried and Underground Piping and Tanks

This program is implemented at Ginna through its "Buried Piping and Tanks Inspection" AMP B.2.1.7 and its "Buried Piping and Tanks Surveillance" AMP B2.1.28. Neither of these AMPs state any exceptions or enhancements to GALL, Rev. 0, nor are any commitments identified. After Ginna clarified during the license renewal process that the inspection of buried tanks and piping is carried out under the Ginna One-Time Inspection Program, the NRC staff found the Ginna Buried Piping and Tanks Inspection Program to be acceptable, as submitted in the LRA.

Comment [MRF67]: The AMP was subsequently changed to be consistent with GALL Report, R0, AMP XI.M34 just like NMP1. This was done before entry into the PEO and was looked at as part of the IP71003 inspection. Additionally, the AMP has since been revised on a fleet basis to be consistent with the NEI 09-14 initiative as mandated by NSIAC. This is also true for NMP1.

NMP-1 implements this program through its "Buried Piping and Tanks Inspection Program" AMP B2.1.22. This AMP identifies no exceptions or enhancements to GALL, Rev. 0, AMP XI.M34. The following commitment is stated: "Develop and implement a Buried Piping and Tank Inspection Program which includes a requirement that if an opportunistic inspection does not occur within the first ten years of extended operation, NMP-1 will excavate a representative sample for the purpose of inspection." This commitment is to be met prior to entering the PEO.

According to the Ginna SER, Section 2.3.2.3.1, Ginna relies on its Periodic Surveillance and Preventive Maintenance Program to carry out inspections of underground piping and tanks, and these inspections are performed on an opportunistic basis. No directed periodic inspections are indicated in the Ginna AMP, and this was confirmed by the Ginna program owner during the audit interview. However, the NMP-1 LRA includes a commitment to excavate degradation-susceptible areas to perform focused inspections if an opportunistic inspection has not occurred within the past 10 years at the time of initial license renewal.

The NMP-1 Program Basis Document for this AMP initially developed per GALL Rev. 0 was revised to meet the requirements of GALL Rev. 1 in 2006. The new program includes a requirement that before entry into the PEO, if an opportunistic inspection has not occurred within the past ten years, NMP-1 will excavate degradation-susceptible areas to perform focused inspections. The program was initially established due to license renewal requirements, and has been expanded in response to industry issues related to buried piping components.

A new procedure NEP-BPT-INSP-01 Rev. 00 "Buried Piping and Tanks Inspection Program" was created in 2007 to provide instructions for implementing the LR Buried Piping and Tanks Inspection Program at NMP-1. Prior to entering the period of extended operation, NMP-1 will verify that there has been at least one opportunistic or focused inspection within the past 10 years. Upon entering the period of extended operation, NMP will perform a focused inspection within 10 years, unless an opportunistic inspection occurred within this 10-year period.

This NMP-1 AMP is intended to meet the requirements of the Nuclear Strategic Issues Advisory Committee (NSIAC) Buried Piping Integrity Initiative and NEI 09-14, "Guideline for the Management of Buried Piping Integrity." It was stated during the audit that NMP-1 is in the process of revising this procedure. It was also stated that the underground pipe and tank program continues to be enhanced.

Systems and components included in the program have been identified and risk ranked, and an inspection plan in accordance with the risk ranking results and the NSIAC initiative has been developed. Asbestos cement pipe was initially excluded from the scope of the program but added in to meet the NSAIC scope.

A visual inspection of a hydrant, stand pipe, and its associated buried isolation valve at NMP-1 was completed in 2007. The piping was asbestos cement material. The inspection found the piping to be in exceptionally good condition with no aging effects noted. Soil samples that came into contact with the various components were taken and analyzed, and the corrosion potential was found to be low for cement pipe and moderate for steel pipe. The inspection team identified that this inspection location was not a high risk location because it was above the water table.

In September 2011, a CR was initiated due to a failure of a buried city water cement/asbestos pipe at NMP-1. The event was determined to be a singular random event failure due to foreign object impingement on the piping (large rock in original construction backfill that impinged on piping due to excessive overhead loading during the past heavy haul movements). In addition, DER2003-1319 "Overall Assessment of the Significant of Nine Mile Point Fire Water System Corrosion" identified piping and valves corrosion and leaks in several areas as a result of internal piping degradation. None of the defects found represented an impending failure of fire water system piping or valves.

2.3.39 X.M1 Fatigue Monitoring

The NMP-1 Fatigue Monitoring Program (FMP) is an existing program that manages the TLAAs related to metal fatigue of carbon steel, low alloy steel, stainless steel and nickel alloy components. The FMP manages the fatigue life of reactor coolant pressure boundary components by tracking and evaluating key plant events. Events were selected based upon plant-specific evaluations of the most fatigue-limited locations for critical components, including those discussed in NUREG/CR-6260. The FMP monitors operating transients, calculates cumulative usage factors, and directs performance of engineering evaluations to develop preventive and mitigative measures to ensure that the design limit on fatigue usage is not exceeded. The effects of reactor coolant environment are considered through the evaluation of, as a minimum, those components selected in NUREG/CR-6260 using the appropriate environmental fatigue factors.

In 1999, prior to submitting the LRA, the NMP engineering personnel discovered that several transients affecting the NMP-1 reactor pressure vessel recirculation inlet and outlet nozzles were not required to be tracked per the FMP. An analysis of the fatigue effects of these additional cycles was performed and the fatigue usage contribution of the cycles was found to be small. However, these seven transients have been added to list of transients that must be tracked for NMP-1. In addition, the NMP-1 FMP will be enhanced with guidance for the use of the FatiguePro software package and updated methodology for calculating environmental correction factors in establishing updated fatigue cumulative usage factor (CUF) values.

The OpE at NMP-1 showed that cracking was detected in a FW nozzle in 1977. The NMP-1 and industry experience on FW nozzle cracking has demonstrated the potential of this location to accumulate significant fatigue usage during plant operation. The staff noted that the FW nozzle is the best choice for stress based fatigue methodology for calculating fatigue usage factors. The staff also noted that self assessment of FMP indicated that, in 2009, the recirculation nozzles were reanalyzed satisfactorily using all 6 directional stressors as input to the Green's Theorem portion of the overall fatigue analysis algorithm (addressing the NRC concerns in RIS 2008-30) and the CUF was less than 1.0 as required by the ASME code

The FMP at Ginna is a newly incorporated program that is consistent with the NRC GALL Rev. 1 Report, Section X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary." The Ginna SER for license renewal does not identify any exception or enhancement in comparison to GALL Rev. 1 program. The program monitors loading cycles due to thermal and pressure transients for selected critical components.

The scope of the FMP includes those plant systems and components for which a cyclic or fatigue design basis exists. The specific systems and components include:

- reactor pressure vessel closure studs,
- reactor pressure vessel primary (inlet and outlet) nozzles,
- reactor pressure vessel at core support pad,
- steam generator tubesheet,
- cold leg (accumulator) safety injection nozzle,
- pressurizer upper shell and spray nozzle,
- pressurizer surge line nozzle,
- hot leg surge line nozzle,
- pressurizer surge line,
- pressurizer heater well penetration,
- reactor coolant piping charging system nozzles,
- residual heat removal hot leg suction nozzles, and
- residual heat removal system Class 1 piping.

2.4 AMPs for Structures

The 8 AMPs numbered XI.S1 through XI.S8 in Chapter XI of the GALL Report, Rev. 2 and one AMP numbered X.S1 in Chapter X of the report for structures are discussed in this section, along with 2 plant-specific AMPs developed by NMP-1. The program description of the AMP summarizes, in no more than a few paragraphs, the aging effect to be managed, the aging mechanism(s) responsible for this effect, the overall approach proposed to manage this aging effect, and the technical basis for this approach. In general, the program descriptions provided in the Ginna and NMP-1 ~~AMPS~~ AMPs for structures, which were prepared under GALL Rev. 0 guidance, met these objectives. Furthermore, the GALL Rev. 2, states that this program element should include the specific structures and components that are subject to an aging management review. The Ginna and NMP-1 AMPs generally satisfied this requirement as well.

2.4.1 XI.S1 ASME Section XI, Subsection IWE

Ginna implements GALL AMP XI.S1 ASME Section XI, Subsection IWE combined with XI. S2 ASME Section XI, Subsection IWL through its existing ~~its~~ "ASME Section XI, Subsections IWE & IWL Inservice Inspection" AMP B2.1.3. Ginna has a prestressed concrete containment, and Ginna's IWE/IWL Program manages aging of: (a) steel liners of concrete containments and their integral attachments; containment hatches and airlocks; seals, gaskets and moisture barriers; and pressure retaining bolting, and (b) reinforced concrete containments and unbonded post-tensioning systems. Visual examinations are performed with limited supplemental volumetric and surface examinations as necessary. Tendon anchorages and wires are visually examined. Tendon wires are tested for verification that minimum mechanical properties requirements are met. Tendon corrosion protection medium is analyzed for alkaline content and soluble ion concentrations. Prestressing forces are measured in randomly selected sample tendons. Ginna has a separated AMP, "Concrete Containment Tendon Prestress" AMP B3.3 for managing TLAA to address loss of tendon prestressing (see Section 2.2.9 of this report). The Ginna~~'s~~ IWE/IWL AMP also incorporates 10 CFR 50 Appendix J containment leak rate tests.

The Ginna LRA indicates the following plant-specific experience:

- Loss of pre-stress in most containment tendons requiring re-tensioning of 137 tendons;
- Containment moisture barrier found to be out of conformance with drawing; loose insulation; non-conformance corrected by recaulking;
- Minor corrosion of steel containment liner; wall thickness verified by UT; restoration of protective paint coating;
- Low grease levels in certain tendon grease cans at top of containment; cans refilled;

- Corroded and leaking tendon fill-port piping; all fill ports repaired.

The Ginna containment is unique and different from a regular prestressed concrete containment. The vertical tendons are anchored at the base to rock anchors by bellows. In addition, there are neoprene pads embedded in the concrete at the base and spring line of the containment. This unique design required some additional surveillance requirements for the prestressing tendons and containment pressure tests. The containment liner plate at Ginna is covered with insulation between the base slab and a point 10 feet above the spring line. This situation required removal of insulation at the moisture barrier in suspected area at the base slab to inspect the liner plate.

Major AMP implementation gaps and observations from the audit include:

- Ginna's IWE/IWL program was written based on GALL, Rev. 0. ~~The AMP appears to not have included operating experience concerning liner plate corrosion behind the insulation at the Salem and Robinson plants and recent NRC Information Notices concerning liner plate and concrete containment inspection. These include IN 2010-12 and IN 2011-15.~~
- The AMP basis document has not been updated. The program currently being implemented in accordance with ASME 2004 code; however, the basis document still ~~references~~ referenced the 1995 edition of the code.
- **Neoprene pads are not inspected during surveillance activities.**
- The licensee photographed the whole of the containment surface as a baseline record prior to PEO in 2002-2003.
- Ginna installed fiber optic strain gages on 20 of the 160 tendons.

Comment [MRF68]: Given that there was not the request made by the NRC Audit attendees to look at the Corrective Action Program evaluations of the referenced INs, it is inappropriate to surmise that the AMP "appears to not have included operating experience...IN 2010-12 and IN 2011-15." All that was needed was the request be made by the Audit Team to see these evaluations and they would have been provided consistent with those provided during the NRC's OE Pre-Visit to the AMP Audit.

NMP-1 has a Mark-I steel containment. NMP-1 implements GALL AMP XI. S1 through its "ASME Section XI Inservice Inspection (Subsection IWE) Program" AMP B2.1.23. This is an existing program that manages aging effects due to: (1) corrosion of carbon steel components comprising the NMP-1 containment pressure boundaries; and (2) degradation of NMP-1 containment pressure-retaining polymers. The program is based on the 1998 edition of the ASME Code, Section XI (Subsection IWE) for containment ISI with plant-specific exceptions approved by the NRC. The NMP-1's IWE program is supplemented by two additional plant-specific programs, "Drywell Supplemental Inspection Program" and "Torus Corrosion Program." The former is used to manage general corrosion in six localized areas of the drywell that were exposed to aggressive cleaning chemicals. The latter manages corrosion of the torus and its support structures. The IWE program also monitors the condition of the drywell sand cushion area.

Comment [MRF69]: See Comment MRF 2

The containment surfaces are inspected for degradation and corrosion. The drywell sand cushion area was inspected in 1995 and 2007 using a boroscope. The drains were found to be open with no trace of water or corrosion. There is no plan for additional boroscope examination during PEO. However, the openings in the drain lines in the torus room are inspected during every outage.

The acceptance criteria for the NMP-1 containment inspection program consist of the following elements:

(1) The projected containment wall thickness at the end of PEO should be greater than the minimum design wall thickness. The wall thickness and corrosion rate (mils/year) should be periodically measured in accordance with IWE requirements.

(2) Torus shell thickness should not be less than the required thickness through the PEO.

(3) Acceptance criteria of local wall thickness and average wall thickness, and conservative corrosion rates should be established. The minimum wall thickness and corrosion rate limits should be defined to ensure that the minimum wall thickness requirement will not be violated before the next scheduled inspection.

Major observations from the NMP-1 audit include:

- The torus is uncoated, and its thickness has reduced ~~and is~~in isolated local pits to less than 10 mils more than minimum design thickness. ~~The torus needs to be coated soon; however, the licensee has not made any decision on this subject.~~
- NMP-1 monitors torus thickness of the underwater surface by external UT of the pre-selected areas, and measuring corrosion rate of coupons installed in the torus. ~~It was noted that this procedure may miss the detection of localized corrosion such as pitting.~~

2.4.2 XI.S2 ASME Section XI, Subsection IWL

Ginna has a prestressed concrete containment. As stated in Section 2.4.1, Ginna combines this program with GALL XI.S1 ASME Section XI, Subsections IWE through its "ASME Section XI, Subsections IWE & IWL Inservice Inspection" AMP B2.1.3. In addition, Ginna has a separated time-limited aging analysis (TLAA) AMP, "Concrete Containment Tendon Prestress" AMP B3.3 for managing loss of tendon prestressing. Ginna's IWE/IWL AMP also manages 10 CFR 50 Appendix J containment leak rate tests. NMP-1 has a Mark I steel containment and this program is not applicable.

Ginna's IWE & IWL program consists of: (a) periodic visual inspections of concrete surfaces for the prestressed concrete containment, (b) periodic visual inspections and sample tendon testing of unbonded post-tensioning systems for evidence of degradation, and (c) assessment of damage and corrective actions. Measured tendon lift-off forces are compared to the predicted tendon forces calculated in accordance with NRC RG 1.35.

The evaluation of Ginna's IWL/IWE program regarding to the prestressed containment and prestressing tendon systems are described in Sections 2.4.1 and 2.4.9. Some observations in Ginna's IWE AMP described in Section 2.4.1 also apply here, including:

- ~~Ginna's IWE/IWL program was developed based on GALL Rev. 0. Recommendations in GALL Rev. 2 are not used.~~
- ~~The AMP does not appear to include operating experience concerning liner plate corrosion behind the insulation at Salem and Robinson plants and recent NRC Information Notices concerning liner plate and concrete containment inspection.~~
- The AMP basis document has not been updated. The program is currently being implemented in accordance with ASME 2004 code; however, the basis document ~~still references~~referenced the 1995 edition of the code.

2.4.3 XI.S3 ASME Section XI, Subsection IWF

Ginna implements this program through its "ASME Section XI, Subsections IWF Inservice Inspection" AMP B2.1.4 and NMP-1 through its existing "ASME Section XI Inservice Inspection (Subsection IWF) Program" AMP B2.1.25. The Ginna's IWF program consists of periodic visual examinations of component supports for evidence of degradation. The program provides for evaluation of inspection results and appropriate corrective actions.

It was noted in the audit that a license renewal commitment regarding volumetric (UT) examination of the high-strength bolts in the SER was eliminated by a 10 CFR 50.59 evaluation. The licensee indicated that the high-strength bolts in the systems were replaced due to potential or actual SCC, and the licensee has used a 10 CFR 50.59 approach to eliminate the commitment to perform UT examination of high-strength bolts. The basis for this change was based on ASME Subsection IWF and plant-specific operating experience. The ~~plant~~ program basis document, LR-IWF-PROGPLAN, cites the operating experience for high-strength bolt failures and their removal. The 56 bolts were tightened using a standard stud wrench, which eliminated the excessively high pre-load. Inspections during subsequent outages revealed no evidence of bolt distress. Based on limited information provided in the ~~plant~~ program basis document, this commitment change appears to be acceptable.

Other observations from the audit of Ginna's IWF AMP include:

Comment [MRF70]: This is an incorrect statement. The Torus Corrosion Monitoring Program is being conducted per NRC approval in the SER that it generated after reviewing the program. It was the opinion of the Audit attendee that the Torus be coated and NMP1 has recognized that this is a contingency that may be needed if and when the plant applies for license renewal beyond 60 years. At the current corrosion rate, which is recalculated after every RFO, after the requisite Torus inspections, the minimum design thickness will not be reached at those worse case locations by the time the plant life reaches 60 years.

Comment [MRF71]: Again, this is supposition by the Audit attendee. When Containment is inerted, there is not enough oxygen present to sustain a significant material loss rate. The only times Containment is not inerted is during refueling outages which are typically around 3 weeks in length or, possibly, during a forced outage when Containment entry is required. Material loss rates are monitored per the NRC approved program, as indicated above, and the degraded locations are monitored every outage.

Comment [MRF72]: This is incorrect. The IWE/IWL AMP was based on the then current version of the ASME Code consistent with 10 CFR 50.55a. The GALL Report lags updates of the code and no one in the industry bases their IWE/IWL program on the GALL Report. They update their AMP based on the law, 10 CFR 50.55a.

Comment [MRF73]: See Comment MRF 68.

- The licensee cleaned and painted all component anchor bolts located in the sub-basement to inhibit corrosion.
- The AMP basis document has not been updated. The program currently being implemented in accordance with ASME 2004 code; however, the basis document still references 2001 edition of the code.
- The licensee has not revised the program to incorporate GALL Rev. 1 or 2 recommendations. GALL, Rev. 2, is augmented to include monitoring of high-strength structural bolting based on NUREG-1339 and industry recommendations. The Ginna IWF AMP was developed based on GALL Rev. 0.

The NMP-1 IWF Program is an existing program that manages aging of carbon steel component and piping supports, including ASME Class MC supports, due to general corrosion and wear. Program activities include visual examinations to determine the general mechanical and structural condition of components and their supports. The program is based on the 1989 edition of the ASME Section XI (Subsection IWF) for ISI of supports; it implements the alternate examination requirements of ASME Code Case N-491-1.

Comment [MRF74]: See Comment MRF 2.

~~It was noted that the NMP-1 IWF AMP does not include inaccessible piping supports. This may be attributed to the fact that the GALL IWF AMP only recommends inspection of piping and components supports that are not exempt from ASME IWF -1230 and MC supports. The Scope of Program in GALL Rev. 2, states, "this program addresses supports for ASME Class 1, 2, and 3 piping and components supports that are not exempt from examination in accordance with IWF-1230 and MC supports. Exemptions, as stated in IWB-1220, include portions of supports that are inaccessible due to being encased in concrete, buried underground, or encapsulated by guard pipe. Note that inaccessible components are included in the scope of GALL AMP XI.S2 IWE AMP, which states that the licensee is to evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas.~~

Comment [MRF75]: The IWF AMP contains the requirements of the current version of the code on which the AMP is based per 10 CFR 50.55a.

Other observations from the audit of NMP-1's IWF AMP include:

- The most recent quarterly Health Reports of ISI Program (7-/1/11-9/30/11) is rated ACCEPTABLE and GREEN ~~with over all status rating of 88.73.~~
- ~~The licensee has not revised the program to incorporate GALL Rev. 1 or 2 recommendations. GALL, Rev. 2, is augmented to include monitoring of high-strength structural bolting based on NUREG-1339 and industry recommendations. Ginna IWF AMP was developed based on GALL, Rev. 0, such that monitoring high-strength bolting is not included.~~

Comment [MRF76]: Since the context of the grading system is not detailed in any way, and this is the only place in the report where a Program Health Report score is cited, the reader has no basis on which to understand what the numerical value means. It is sufficient to say that it was GREEN.

Comment [MRF77]: This AMP will always be revised per the requirements of the law, 10 CFR 50.55a, and not a NUREG which is just a guidance document. Additionally, the current version of the Code is always reviewed by the NRC to ensure that the requisite aging management activities are included in the Code so that when each licensee updates their ISI Program per 10 CFR 50.55a, they are managing the aging of the applicable components per the NRC's review and approval.

2.4.4 XI.S4 10 CFR 50, Appendix J

As stated in Section 2.4.1, Ginna implements this program through its "ASME Section XI, Subsections IWE & IWL Inservice Inspection," AMP B2.1.3. Ginna uses the containment IWE/IWL program and containment leak rate testing to manage the aging effects of cracking and corrosion for penetration sleeves, bellows, and dissimilar metal welds, corrosion, and loss of leak tightness due to wear of personnel airlock and equipment hatch, and loss of sealant and leakage in containment seals, gaskets, and moisture barriers. Additionally Ginna's "Periodic Surveillance and Preventive Maintenance Program" (B2.1.3) also requires visual inspections of hatches, hinges, locks, and closure mechanisms, as well as elastomeric seals associated with the containment air locks. It is also credited for managing the aging effects of loss of material due to corrosion and loss of leak tightness due to mechanical wear of locks, hinges and closure mechanisms.

The Ginna LRA states that its containment program implements and formally adopts the requirements of the ASME Section XI, Subsections IWE & IWL ISI Program as part of the Ginna Station ISI Program. Included in the scope of the IWE program are the exposed portions of the containment liner, the liner for the fuel transfer penetration, all other penetrations, associated bolting, moisture barriers, and all airlocks, seals, gaskets, and penetration bellows previously included in the scope of Appendix J.

NMP-1 implements GALL SI.S4 AMP through its existing "10 CFR 50 Appendix J Program" AMP B2.1.26. The NMP-1's Appendix J Program is an existing program that detects degradation of the containment structure and components that comprise the containment pressure boundary. Containment leak rate tests are performed to assure that leakage through the primary containment, and systems and components penetrating primary containment does not exceed allowable leakage limits specified in the Technical Specifications. This program complies with the Option B requirements of 10 CFR 50 Appendix J with plant-specific exceptions approved by the NRC as part of license amendments, and it implements the guidelines provided in NRC Regulatory NRC RG 1.163 and NEI 94-01.

Incidents of containment leakage that have been detected and documented in the NMP-1 basis document include:

- Leakages on the main steam penetration bellows were detected by Type B test due to cracks in the HAZ of seam welds.
- Containment interior wall leak paths were identified through Type A tests.
- Torus leakages have been reported due to fatigue in the proximity of the high-pressure cooling injection HPCI) system line.

The NMP-1 basis document indicated that Type C test leakages (involving the containment isolation valve) are the most common ~~failure~~ leakage events, and typical corrective actions involve valve disc-to-seat maintenance to improve leak tightness. The basis document also indicated that Type B tests are sufficiently sensitive, and degraded components that impact component leak tightness can be identified as requiring corrective actions.

Overall, it appears that the Appendix J Leak Rate Test AMP at NMP-1 is effective. Containment leakages have been detected and documented and corrective actions were taken.

2.4.5 XI.S5 Masonry Walls

Ginna implements this program through its "Structures Monitoring Program" AMP B2.1.32 and NMP-1 through its existing "Masonry Wall Program" AMP B2.1.27. Masonry walls are used as fire barriers at Ginna Station. The Ginna Structures Monitoring Program includes masonry walls evaluated in accordance with NRC IEB 80-11, "Masonry Wall Design" and incorporates guidance in NRC IN 87-67, "Lessons learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11". Visual examination of masonry walls at Ginna is performed at 5-year intervals.

The NMP-1 LRA states that its Masonry Wall Program manages aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation. The Masonry Wall Program is based on the structures monitoring requirements of 10 CFR 50.65. The Masonry Wall Program is implemented by the Structures Monitoring Program for managing specific aging effects. The program requires periodic visual inspection of masonry walls in the scope of license renewal to detect loss of material and cracking of masonry units and mortar.

There are 150 safety-related masonry walls at NMP-1. Periodic visual inspections are scheduled every 6 years. There are 13 un-braced and non-reinforced safety-related masonry walls, which are scheduled for visual inspections every 4 years per the NMP-1 LR Commitment 39. This is consistent with the "Detection of Aging Effects" program element of GALL AMP XI.S5 that recommends frequent inspections of non-reinforced masonry walls. NMP-1 compares older inspection checklists to recent checklists for trending. In addition, the checklist results are compared to the evaluation basis developed for the respective masonry walls during the resolution of IEB 80-11.

Inspections at 2005 indicated that the masonry walls at NMP-1 are generally in good physical condition, with only a few areas of minor degradation. Deficiencies were evaluated and appropriate corrective actions were taken. The most recent quarterly Health Reports for the program (7-/1/11-9/30/11) rated it as "Acceptable" and "Green." The program appears to be well managed, and there are no accessibility problems or repetitive observations.

2.4.6 XI.S6 Structures Monitoring

Ginna implements this program through its "Structures Monitoring Program" AMP B2.1.32 and NMP-1 through its existing "Structures Monitoring Program" AMP B2.1.28. Ginna's Structures Monitoring Program was developed and implemented to meet the regulatory requirements of the ~~maintenance~~ Maintenance ~~rule~~ Rule (10 CFR 50.65, RG 1.160, and NUMARC 93-01) for managing aging effects in structures. The program also includes management of aging effects of masonry walls, as mentioned above, and water-control structures in accordance with RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants." The program is consistent with GALL Rev. 0 XI.S5," Masonry Wall Program;" XI.S6, "Structures Monitoring Program;" and XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants." Rev. 1 and Rev. 2 of GALL are not used by Ginna.

Visual inspection of the structures, masonry walls, and water-control structures at Ginna is performed at a frequency of 5 years. Since the renewal license was issued, there have been no changes to the AMP implementing procedures with regard to OpE, response to NRC requirements or code changes, or though the 10 CFR 50.59 process.

Other observations at Ginna include:

- The program basis document is not revised when implementing procedures are revised.
- The visual inspection acceptance criteria in the implementing procedure appear less stringent than those specified in American Concrete Institute (ACI) 349.3R, which is cited in GALL.
- ~~As stated above in Section 3.4.5, no formal and comprehensive calculations or documentation exist regarding the degradation of concrete or masonry walls.~~
- There is no indication of stoppage or debris in the leak chase channels of the spent fuel pool because there is continuous flow of water. In addition, no indication of leakage has been found in the accessible outside surfaces of the spent fuel pool. Excavation performed outside near the pool for constructing the spent fuel dry cask storage system also did not find any indication of leakage.

Comment [MRF78]: The Ginna Licensing Basis does not include adoption of ACI 349.3R.

Comment [MRF79]: This comment is not made in Section 2.4.5 above and there is historical documentation maintained relative to the ongoing walkdowns and condition of the concrete and masonry walls.

The NMP-1's Structures Monitoring Program provides for periodic visual inspections, surveys, and examination of all safety-related buildings (including the primary containment and substructures within the primary containment) and various other buildings. The program identifies degradation of materials of construction, which include structural steel, concrete, masonry block, and sealing materials. While not credited for mitigation of aging, protective coatings are also inspected under this program. The program is consistent with GALL XI.S6 "Structures Monitoring Program" with the following enhancements:

- Expand the parameters monitored to include those aging effects requiring management for structural bolting.
- Implement regularly scheduled ground water monitoring to ensure that a benign environment is maintained.
- Expand the scope of the program to include the steel electrical transmission towers required for the Station Blackout (SBO) event and recovery paths that are within the scope of license renewal.
- Expand the program to include Fire Rated Assemblies and Watertight Penetration Visual Inspections.

The program provides for visual inspections and surveys, as well as examinations of all building and structures within the scope of license renewal, including surveys such as displacements of sliding surfaces and seismic gaps between buildings. This is consistent with NRC IN 97-11 (Cement Erosion from Containment Subfoundations at Nuclear Power Plants) and IN 98-26 (Settlement Monitoring and Inspection of Plant Structures Affected by Degradation of Porous Concrete Subfoundations) and assures that inspections of structures include the examination interfaces between structures, when accessible, for indications of building settlement and/or differential settlement.

The details of the inspection intervals are described in the program basis document. The interval depends upon the functions of the particular SCCs. For SSCs for which no degradation or defects were identified in the baseline inspection, the inspection interval is not to exceed ~~24 months~~6 years/3 cycles. For SSCs with evidence of degradation requiring corrective actions or that may require future restoration, an appropriate monitoring frequency is established based on the function and degraded conditions of the SSCs. For degradation not requiring corrective actions, the condition of the degraded areas is to be monitored ~~at~~ during each refueling cycle for a period of at least three cycles.

~~The AMP implements a plant-specific Wooden Power Pole Inspection Program, which manages the aging of wooden power poles that are within the scope of license renewal (i.e., they provide structural support for the transmission lines in the recovery path for SBO). It was noted that the aging management of Wooden Power Pole is not in the GALL report.~~

Comment [MRF80]: This is for NMP2 only.

Similar to Ginna, groundwater penetration and leakage is an occurrence at NMP-1. Ground water leakage appears to be ~~common~~seasonal, with persistent ground water leakage in ~~some structures~~one location. The NMP-1 OpE (SER Section 3.0.3.3.21) states that minor cracking is present in various concrete structures, and slight (but stable) ground water leaks in some tunnels. ~~Several CRs have confirmed minor cracking in concrete structures, including the service water pipe tunnel, and allowing leakage of ground water. Groundwater also has entered switchgear building, service water tunnels, and the radwaste building of below grade exterior walls.~~

Comment [MRF81]: See MRF Comment 80.

NMP-1 has nine wells for groundwater monitoring through routine sampling and analysis of groundwater conditions. The groundwater chemistry is sampled at least once every 6 months for corrosive indicators. This frequency is much higher than that recommended in GALL (every 5 years). Previous tests in NMP-1 indicate the presence of chlorides at greater than 500 ppm~~(?)~~, sulfate greater than 1500 ppm~~(?)~~, and pH less than 5.5 in some wells. The licensee stated that these aggressive groundwater conditions are localized. The program requires that, following an unusual event such as earthquake, tornado, or flooding, an initial inspection should be conducted to assess the condition of the affected SSCs. A follow-on complete structural inspection may be required, depending on the assessment. This requirement is not present in the GALL.

Comment [MRF82]: Since 2008, Chlorides have been out of spec. 6 times, and sulfate only once. These were not near NMP1. They were close to site roads where road salt is used during the winter.

Other observations of potential AMP technical and implementation weakness, and other general observations from the audit of NMP-1's Structures Monitoring Program include:

- The AMP implementing procedure has personnel qualification requirements that are different from those in ACI 349.3R, which is cited in GALL. During the interview, the licensee stated that the requirements are comparable.
- The licensee does not maintain and continuously update the baseline data resulting from the inspections. The licensee stated that the inspectors review CRs for the two previous outages before walkdowns to identify any specific areas of concern.
- The walkdown check list does not contain any specific quantitative criteria, as recommended in ACI 349.3R. GALL Rev. 2 states that applicants that are not committed to ACI 349.3R and elect to use plant specific criteria for concrete structures should describe the criteria and technical basis for deviation from those in ACI 349.3R. However, the NMP-1 AMP is based on GALL Rev. 0.
- The AMP implementing procedure states that that submerged structures such as the intake tunnel are to be inspected, if possible. Previously, the licensee sent divers to inspect the tunnel, and minor cracking was identified. Now the licensee is planning to use a small remotely operated submarine-type vehicle to inspect the tunnel.
- The licensee inspects structural components such as cable trays and conduit supports using the sampling technique described in EPRI NP-7218. This unique approach has not been used at other plants. GALL Report does not recommend this approach, and instead requires 100 percent inspection.
- No indications of fuel pool and reactor cavity leakage have been found.

Comment [MRF83]: The AMP Owner does maintain documentation under this AMP with a report that is generated after each walkdown that is performed and all are available for review.

Comment [MRF84]: The NMP1 Licensing Basis does not include adoption of ACI 349.3R.

Comment [MRF85]: There have been no divers and no identified crack where the submersible has been sent.

Comment [MRF86]: This document was used as guidance for snubber testing.

2.4.7 XI.S7 RG 1.127 Inspection of Water-Control Structures Associated with Nuclear Power Plants

Ginna implements this program through its "Structures Monitoring Program" AMP B2.1.32. Ginna water-control structures include the circulating water system discharge canal, the canal interface with the pump screen house, and a stone revetment that protects the site from storm surge flooding. No earthen water control structures are used at Ginna Station. The Ginna LRA stated that large armor stones are used in the revetment, which underwent a site-specific review by the Army Corps of Engineers in the review of Systematic Evaluation Program topics: II-3.A, II-3.B and II-3.C; "Hydrology, Flooding, and Ultimate Heat Sink." The Structures Monitoring Program and Periodic Surveillance and Preventive Maintenance Programs execute the recommendations made by the Corps by performing surveys and inspections of the armor stone and cap rocks to ensure that erosion and stone movement do not compromise the effectiveness of the water control structure.

This program is not being used at NMP-1, instead, underwater inspections are performed as a repetitive task as part of the NMP-1 Periodic Surveillance and Preventive Maintenance Program. The Periodic Surveillance and Preventive Maintenance Program also inspects for silting and fouling of water control structures. Divers and submarine mounted cameras are used to inspect the underwater surfaces of the Screen House, discharge canal, canal valves and weir gates, and the intake tunnels and structure. Results of these inspections are reviewed by qualified engineers as part of the Structures Monitoring Program. Concrete used in water control structures has been evaluated for the aging mechanisms of freeze-thaw, leaching of calcium hydroxide, reaction with aggregates, corrosion of embedded steel, aggressive chemical attack, settlement, and abrasion. NMP-1's Structures Monitoring Program and the Periodic Surveillance and Preventive Maintenance Program appear to be effective in managing aging effects of water-control structures of NMP-1.

2.4.8 XI.S8 Protective Coating Monitoring and Maintenance Program

Ginna implements this program through its "Protective Coatings Monitoring and Maintenance Program," AMP B2.1.24 and NMP-1 through its "Protective ~~Coatinq~~Coating Monitoring and Maintenance Program," AMP B2.1.38. Ginna has done extensive work related to Generic Safety Issue (GSI)-191, an open generic safety issue regarding the clogging of containment emergency sumps. In order to address GSI-191, Ginna developed the containment coatings condition assessment procedure, EP-3-P-060, that allows for analysis assumptions to be verified and ensures that design margin with respect to degraded and unqualified coatings is maintained. Ginna devoted significant effort to improving AMP elements 3, *(Parameters Monitored, Inspected, and/or Tested)* 4, *(Detection of Aging Effects)* and 5 *(Monitoring and Trending)*. By the end of 2008, Ginna had completed the installation of replacement sump strainers. The audit determined that there were 11 coatings-related CRs included in the Ginna LR CR Trending Documents (TDs). Numerous other cases of containment liner corrosion were discovered. The causes of these instances of corrosion included degraded coatings, degraded moisture barrier seals, or water accumulation from various sources such as condensation from the internal air condition on the liner surface. The inspection of coatings is performed at each refueling outage (~~approx.~~ every **18**~~-24~~ months). The inspection conducted in 2009 indicated that the total amount of degraded containment coatings was 223 ft^2, or less than ¼ of the total amount permitted to ensure post-accident operability of the ECC suction strainers.

The Ginna AMP owners and the NRC staff also suggested updating of GALL AMP XI.S8 to incorporate the guidance of ASTM D7230-06, Standard Guide for Evaluating Polymeric Lining Systems for Water Immersion in Coating Service Level III Safety-Related Applications on Metal Substrates, July 1, 2006. They also suggested the inclusion of both Service Level II and III coatings in the AMP. As stated in Rev. 2 of RG 1.54, Service Level III coatings are used in areas outside the reactor containment where failure could adversely affect the safety function of a safety-related SSC.

The NMP-1's Protective Coating Monitoring and Maintenance Program is an existing program that applies to Service Level I protective coatings inside the primary containment and items within the torus (outside surface of the vent (ring) header and downcomer, inside surface of the vent piping, ring header, vent header junctions, and downcomers). The program has the following enhancements:

- Visual examination of coated surfaces for any visible defects including blistering, cracking, flaking, peeling, and physical or mechanical damage.
- Inspection of coatings during every refueling outage.
- Minimum qualifications for inspection personnel, inspection coordinators, and inspection results evaluators.
- Thorough visual inspections in areas noted as deficient concurrently with general visual inspections.
- ~~Specififcation~~ Specification of -the types of instruments and equipment that may be used for inspections.
- Reviews of the previous two monitoring reports before the condition assessment.
- Guidelines for prioritization of repair areas to be monitored until they are repaired.
- Inspection results evaluators to determine which areas are unacceptable and to initiate corrective action.

As stated in the AMP basis document, once an area in containment with cracks, peeling, or delaminated coating has been detected, visual estimation will be used to quantify the surface area. Conservative estimates will be made using known structural dimensions to quantify the total amount of degraded coatings. The total amount of degraded coatings is then compared to the total amount of permitted degraded coatings to ensure post-accident operability of the emergency core-~~coolinf~~ cooling system (ECCS) suction strainers. Should the conservative estimate of degraded coatings exceed the permitted amount, more definitive measurements could be taken or coating repairs immediately undertaken. In the 2011 coatings inspection, it was found that the total amount of failed coating available for transport to the ECCS suction strainers was conservatively estimated about 52.6 lbs, which is below the allowed 85 lbs. in design calculations. There have been no dramatic changes during the three previous outages.

2.4.9 X.S1 Concrete Containment Tendon Prestress

Ginna has a prestressed concrete containment. Ginna implements a time-limited aging analysis (TLAA) AMP through its "Concrete Containment Tendon Prestress" AMP B3.3. This program is not applicable to NMP-1, which has a steel containment. The Ginna's Concrete Containment Tendon Prestress Program is consistent with GALL Rev. 0 AMP X.S1. The acceptance criteria are consistent with the methodology of RG 1.35.1, and are based on a predicted lower limit (PLL) prestressing force and the minimum required prestressing force, also called minimum required value (MRV). The trending of prestressing forces follows the guidance of IN 99-10.

Ginna ~~has~~ had two commitments in ~~the~~ Appendix A of the SER related to this AMP ~~prior the end of current license period~~.

1. The initial re-tensioned set of 23 tendons ~~should~~ were to be re-tensioned to ensure that prestressing forces remained above the MRV during the period of extended operation (Commitment 6). This was completed in 2005, 4 years prior to entry into the PEO.
2. Perform two structural integrity **tests at** design pressure during period of extended operation (Commitment 27). The first of these was completed during the 2011 refueling outage. The second will be performed in 2020 or 2021. ~~(commitment 27)~~

The Ginna Station re-tensioned 23 of the 160 vertical tendons 1,000 h after initial prestressing. Subsequent tests determined that the tendon lift-off forces were generally lower than the predicted values. The investigation concluded that the accelerated loss of lift-off forces was caused by stress relaxation of the tendon wires. Tendon stress relaxation **tests** conducted at Lehigh University, in preparation for the installation of fiber optic strain gages on 20 of the 160 tendon locations, indicated that this stress relaxation over time was caused by the increase in temperature from ambient conditions to operating conditions. ~~The TLAA AMP for the evaluation of loss of prestress in the Ginna containment tendons concluded that the initial retensioned set of 23 tendons should be retensioned prior to the end of~~

~~the current licensing period to ensure that prestressing forces remain above the MRV during the period of extended operation.~~

Comment [MRF87]: This is redundant to the information presented above in Item 1 for the 2 LR Commitments related to this AMP.

In the SER, the NRC staff found that evaluation of the structural integrity test (SIT) results would reveal if there is a gross change in the containment behavior, which would, in turn, indicate significant degradation of the inaccessible components in the containment. Other observations from the audit include:

1. Ginna containment is unique and different from a regular prestressed concrete containment. The vertical tendons are anchored at the base to rock anchors by bellows. In addition, there are neoprene pads embedded in the concrete at the base and spring line of containment. This unique design required some additional surveillance requirements for the prestressing tendons and containment pressure tests.
2. ~~Strain~~ The strain gauges that were installed ~~in the prestress~~at 20 of the 160 **tendon** locations to measure the tendon forces and possible loss of prestress were installed for research purposes. The lift-off testing of 14 random tendons every 5 years that is required by the current AMP will continue.

2.4.10 NMP-1 Drywell Supplemental Inspection Program (Plant-Specific)

The Drywell **Supplement**al Inspection Program at NMP-1 is a plant-specific program that ~~manages~~ managed aging effects at six localized areas of the drywell shell that ~~have~~ had suffered corrosion in the past. These six areas are located near and underneath the drywell coolers on the 225' elevation. The degradation was due to use of chemicals for cleaning the coils of the drywell coolers, which was discontinued once the degradation was realized. This program ~~provides~~ provided aging management activities for the six localized areas, in addition to the activities required by the ASME Section XI ISI (Subsection IWE) Program.

To ensure that the aging effects of the drywell shell ~~are~~ were managed in the PEO, the AMP ~~relies~~ relied on the following activities:

1. **Perform**ed volumetric examinations on the drywell shell during the refueling outage in accordance with ASME IWE requirements and **perform**ed engineering evaluations to determine necessary actions.
2. **Establish**ed the acceptance criteria based on the calculated corrosion rate (mil/years), margin to design thickness (mils), and the projected wall thickness at the end of extended operation. Depending on observed (or, calculated) corrosion rate, intervals between UT measurements may have **range**d from 2 years to 10 years.
3. **Monitor**ed the shell thickness to ensure pressure boundary function ~~is~~ was maintained through the PEO.

The program ~~is~~ was consistent with GALL report Rev. 2 AMP XI.S1 and ASME Section XI IWE requirements, which require augmented inspection if the loss in thickness is greater than 10% of the nominal wall thickness in local areas. However, the licensee found general corrosion of about 5% of the nominal thickness in six areas and determined that a special monitoring program ~~is~~ was necessary to ensure that the reduced thickness is within the design requirements during the period of extended operations.

NMP-1 has a commitment (commitment 42) in the SER to perform volumetric examinations on the NMP-1 drywell shell during the 2007 refueling outage. An engineering evaluation would then be performed to determine the actions necessary for operation through the period of extended operation, in accordance with the NMP-1 Drywell Supplemental Inspection Program. UT measurements were performed in 2007 and 2009 to establish a trend in the loss of thickness, which was virtually non-existent due to the Containment being nitrogen inerted during operation. After measurements, the six areas were cleaned and recoated with a two-part epoxy Carboline coating. Now that this epoxy coating has been applied, it will be monitored by the Service Level I Coatings AMP and the Drywell will continue to be inspected under the ASME Section XI IWE AMP (which has the same action requirements as the Drywell

Supplemental Inspection Program); however, the plant specific Drywell Supplemental Inspection Program has now been discontinued.

~~NMP-1 has established the detailed acceptance criteria based on the calculated corrosion rate (mil/years), margin to design thickness (mils), and the projected wall thickness at the end of extended operation as shown below. Depending on the calculated corrosion rate, UT measurements are performed at intervals ranging from 2 to 10 years.~~

~~Corrosion rate, mils/yr~~	~~Margin (mils)~~	~~Years to min. design thickness~~	~~Required Action~~
~~< 0.3~~	~~> 49~~	~~> 190~~	~~None~~
~~0.30 – 0.60~~	~~41 – 19~~	~~93 – 190~~	~~Confirmatory UT every 10 years~~
~~0.60 – 1.25~~	~~25 – 41~~	~~45 – 93~~	~~Confirmatory UT every 6 years~~
~~1.25 – 2.2~~	~~0 – 25~~	~~26 – 45~~	~~Confirmatory UT every 4 years and implement mitigation strategy~~
~~-2.2~~	~~0~~	~~< 26~~	~~Confirmatory UT every 2 years and implement mitigation strategy~~

~~The program appears effective, with detailed acceptance criteria and UT measurement intervals in place.~~

Comment [MRF88]: This information is no longer applicable since the areas have been coated and the Supplemental AMP has been discontinued.

2.4.11 NMP-1 Torus Corrosion Monitoring Program (Plant-Specific)

The Torus Corrosion Monitoring Program at NMP-1 is an existing plant-specific AMP used to obtain and analyze NMP-1 Torus wall thickness data for use in establishing the torus shell material ongoing corrosion rate and shell wall thickness. The program includes torus UT measurements and torus coupon analysis. The program also provides for visual inspections of the external support structure of the torus. When NMP-1 torus corrosion was found in 1993, NMP submitted the Torus Corrosion Monitoring Program, which included a Torus UT Measurement Program and Torus Coupon Analysis Program, to the NRC for review and approval. The SER approving the overall Torus Corrosion Monitoring Program was issued in 1994 and has been in place since such that it was an existing program credited for torus aging management in the LRA.

The LRA stated that torus wall UT measurements ~~are~~ were obtained at approximately six-month intervals over a predefined grid system, and corrosion sample coupons ~~are~~ were analyzed during each refueling outage. The plant procedure CPR-N1-T-001, Rev. 4 (issued on 02/10/2006) incorporated the commitments of inspection frequency in the LRA. However, in Rev. 5 of this document **(issued** on 1/19/2007 **after the license extension** ~~on 1/19/2007~~**),** the frequency of inspection was revised as follows:

- UT examination of selected areas from outside of torus frequency changed from six months to one year.
- Coupons retrieval from the water line in the torus frequency changed from 2 years to 6 years.

The licensee changed the inspection frequency commitment through ~~a~~ its commitment evaluation process, consistent with the NRC endorsed NEI 99-04 commitment change process, that determined that the corrosion rate in the torus ~~has~~ had been less than what was assumed in the SER and that adequate margin exists ~~against~~ for the minimum required wall thickness of 0.431 in. The licensee basis for this change is that corrosion rate in August 1994 UT examination was 1.243 mils/year. This rate gradually decreased to 0.801 mils/year in 2004. In 2011, the corrosion rate was 0.313 mils/year. However, these corrosion rates do not agree with corrosion rates obtained from the coupons, which was found to be 0.462 mils/year at the last outage.

Comment [MRF89]: The methodology for the determination of the loss rate from one RFO to the next and the projection for when the minimum Torus wall thickness will be reached is per the NRC approved Torus Corrosion Monitoring Program.

In summary, NMP-1 has established the detailed acceptance criteria based on the calculated corrosion rate (mil/years), margin to design thickness (mils), and the projected wall thickness at the end of extended operation. However, the UT measurements are performed on the pre-selected areas with known thinnest average wall thickness. .

2.5 AMPs for Electrical Systems

Three AMPs numbered XI.E1 through XI.E3 in Chapter XI of the GALL Report and 1 AMP in Chapter X are discussed in this section along with 3 site-specific AMPs, The program description of the AMP summarizes the aging effect to be managed, the aging mechanism(s) responsible for this effect, the overall approach proposed to manage this aging effect, and the technical basis for this approach. In general, the program descriptions provided in the Ginna and NMP-1 ~~AMPS~~ AMPs for electrical systems, which were prepared under GALL Rev. 0 guidance met the AMP objectives.

2.5.1 XI.E1 Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

The objective of this AMP is to provide reasonable assurance that the intended function of electrical cables and connections that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse local environments caused by heat, radiation or moisture will be maintained consistent with the current licensing basis through the period of extended operation. As stated in GALL, this is a condition-monitoring program and no actions are taken as part of this program to prevent or mitigate aging degradation. The staff comments and conclusions apply to both Ginna and NMP-1

The evaluation of the effectiveness of the AMP is divided into two parts: (a) assessing the AMP adequacy and (b) evaluating results of the AMP implementation. The information was reviewed to identify good practices or strengths of the AMP and potential areas of the AMP that may require further consideration or enhancements for subsequent operation.

Based on the staff evaluation, the licensees Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is capable of identifying adverse localized environments and identifying affected in-scope cables during the period of extended operation. The implementing procedures and associated work orders did not identify unanticipated component degradation or inconclusive results. The licensee's gap analysis for extending this program beyond 60 years did not identify any major program changes required for operation beyond 60 years.

This program depends on visual inspection of assessable cables. Inaccessible in-scope cables are not inspected directly but are considered to be subjected to the same environment and aging effects of the visually inspected accessible cable.

2.5.2 XI.E2 Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

The objective of this AMP is to provide reasonable assurance that the intended functions of electrical cables and connections (that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are used in instrumentation circuits with sensitive, high-voltage, low-level current signals exposed to adverse localized environments caused by temperature, radiation, or moisture) are maintained consistent with the current licensing basis through the period of extended operation. As stated in GALL, this is a performance-monitoring program and no actions are taken as part of this program to prevent or mitigate aging degradation. The staff comments and conclusions apply to both Ginna and NMP-1

The assessment of AMP effectiveness was conducted at Ginna and NMP-1. The evaluation of the effectiveness of the AMP is divided into two parts: (a) assessing the AMP adequacy and (b) evaluating results of the AMP implementation. The information was reviewed to identify good practices or strengths of the AMP and potential areas of the AMP that may require further consideration or enhancements for subsequent operation. The significant results related to the adequacy of the program description and the effectiveness and implementation of the AMP are summarized below.

Implementation of this program depends on visual inspection of the electrical cables. Inaccessible in-scope cables are not inspected directly but are considered to be subjected to the same environment and aging effects of the visually inspected accessible cable.

Based on the staff review, the licensees XI.E2 program is capable of identifying adverse localized environments and identifying potential degradation affected in-scope cables during the period of extended operation. The implementing procedures and associated work orders did not identify unanticipated component degradation or inconclusive results. The licensee's gap analysis for extending this program beyond 60 years did not identify any major program changes required for operation beyond 60 years.

2.5.3 XI.E3 Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

The objective of this AMP is to provide reasonable assurance that the intended functions of inaccessible or underground power cables that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are exposed to wetting or submergence are maintained consistent with the current licensing basis through the period of extended operation. As stated in GALL, this is a condition-monitoring program. However, periodic actions are taken to prevent inaccessible cables from being exposed to significant moisture, such as identifying and inspecting in-scope accessible cable conduit ends and cable manholes for water collection, and draining the water, as needed. The staff comments and conclusions apply to both Ginna and NMP-1

The assessment of AMP implementation effectiveness at Ginna and NMP-1 was evaluated in two parts: (a) assessing the AMP adequacy and (b) evaluating results of the AMP implementation; the information was reviewed to identify good practices or strengths of the AMP and potential areas of the AMP that may require further consideration or enhancements for subsequent operation.

This AMP applies to all inaccessible or underground (e.g., in conduit, duct bank, or direct buried) power cables (greater than or equal to 400 volts) within the scope of license renewal exposed to adverse environments, primarily significant moisture. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable wetting or submergence in water). Submarine or other cables designed for continuous wetting or submergence are not included in this AMP.

Based on the staff review of the licensees "Inaccessible Medium Voltage Cables" program no concerns were identified, and no any major program changes were recommended for this program.

2.5.4 Metal-Enclosed Bus (site-specific)

The objective of this AMP is to provide an internal and external inspection of Metal Enclosed Buses (MEBs) to identify age-related degradation of insulating material (i.e., porcelain, xenoy, thermoplastic organic polymers), and metallic and elastomeric components (e.g., gaskets, boots, and sealants). As stated in GALL this is a condition monitoring program and no actions are taken as part of this program to prevent or mitigate aging degradation. The staff comments and conclusions apply to both Ginna and NMP-1

The assessment of AMP effectiveness is derived from visits to Ginna and NMP-1. During these visits, the licensee's MEB AMPs were reviewed for the effectiveness of implementation of the AMP. The evaluation of the effectiveness of the AMP is divided into two parts: (a) assessing the AMP adequacy and (b) evaluating results of the AMP implementation.

This program depends on internal and external inspection of MEBs to identify age-related degradation of insulating material (i.e., porcelain, xenoy, thermoplastic organic polymers), and metallic and elastomeric components (e.g., gaskets, boots, and sealants).

Based on the staff review, the licensees program for MEB is capable of inspecting the material condition and components internal to in-scope bus duct. No concerns were identified, nor were any major program changes recommended for this AMP.

2.5.5 Fuse Holders (site specific)

The objective of this AMP is to provide reasonable assurance that the intended function of the metallic clamps of fuse holders are maintained consistent with the current licensing basis through the period of extended operation. It manages fuse holders (metallic clamps) located outside of active devices that are considered susceptible to the following aging effects: increased resistance of connection due to chemical contamination, corrosion, and oxidation or fatigue caused by ohmic heating, thermal cycling, electrical transients, frequent manipulation, or vibration. Fuse holders inside an active device (e.g., switchgear, power supplies, power inverters, battery chargers, and circuit boards) are not within the scope of this AMP. As stated in GALL this is a condition monitoring program and no actions are taken as part of this program to prevent or mitigate aging degradation. The staff comments and conclusions apply to both Ginna and NMP-1.

Implementation of this AMP program depends on testing in-scope fuse holders once every 10 years to provide an indication of the condition. Testing may include thermography, contact resistance testing, or other appropriate testing methods.

The staff concludes that the licensees' Fuse Holders implementation program is capable of inspecting the material condition to detect degradation. The licensee's gap analysis identified this as a new program with a 10-year inspection cycle, (i.e., this program was not part of GALL Rev. 0)

2.5.6 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (site-specific)

The objective of this AMP is to provide reasonable assurance that the intended function of the metallic parts of electrical cable connections that are not subject to the environmental qualification requirements of 10 CFR 50.49 and susceptible to age-related degradation resulting in increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation are maintained consistent with the current licensing basis through the period of extended operation. Cable connections associated with cables within the scope of license renewal that are external connections terminating at active or passive devices, are in the scope of this AMP. Wiring connections internal to an active assembly are considered part of the active assembly and, therefore, are not within the scope of this AMP. This AMP does not include high-voltage (>35 kilovolts) switchyard connections. The cable connections covered under the Environmental Qualification (EQ) program are not included in the scope of this program. This is a condition-monitoring program and no actions are taken as part of this program to prevent or mitigate aging degradation. The staff comments and conclusions apply to both Ginna and NMP-1.

The AMP implementation effectiveness was determined based on information gathered during site visits to Ginna and NMP-1. The information was reviewed to identify good practices or strengths of the AMP and potential areas of the AMP that may require further consideration or enhancements for subsequent operation.

This program depends on one-time testing to verify that increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation is not an aging effect that requires periodic testing.

Based on the review, the staff concluded that, the licensees' program for electrical cable connections is adequate to detect aging (loosening of connection) of the metallic portion of electrical connections. The program tests the increased resistance of connection aging effect associated with the following aging mechanisms: thermal cycling, ohmic heating, electrical transients, electrical transients, vibration, chemical contamination, corrosion, and oxidation. Test methods may include thermography, contact resistance testing, or other appropriate testing methods.

2.5.7 X.E1 Environmental Qualification of Electrical Equipment

The NMP-1 Environmental Qualification Program is an existing program that is consistent with GALL Report AMP X.E1, "Environmental Qualification (EQ) of Electric Components". Environmental Qualification is established by 10 CFR Part 50, Appendix A, Criterion 4, and 10 CFR 50.49. The EQ program demonstrates that certain electrical components located in harsh environments (subject to the harsh environmental effects of a LOCA, high energy line breaks, or post LOCA environment) are qualified to perform their safety function when subjected to a harsh environment after the effects of in-service aging. The effects of significant aging mechanisms are addressed as part of EQ including the replacement or refurbishment components not qualified for the license term prior to the end of designated life. Qualification may also be extended prior to reaching the components qualified life. Aging evaluations for EQ components that specify a qualified life of at least 40 years are considered time limited aging analyses (TLAA) for license renewal.

The EQ program manages thermal, radiation and cyclical aging for electrical equipment. For license renewal, plant EQ programs that implement the requirements of 10 CFR 50.49 are considered AMPs for license renewal. Under 10 CFR 54.21(c)(1)(iii), the effects of aging on the intended functions will be adequately managed for the period of extended operation. Reanalysis of the EQ program aging evaluation completed under 10 CFR 50.49(e) is part of the EQ program. The aging reanalysis considered important attributes including analytical method, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions. If the qualification of component cannot be extended, that component is refurbished, replaced, or re-qualified prior to exceeding the current qualification term (qualified life).

The Ginna Environmental Qualification Program is established by 10 CFR Appendix A, Criterion 4 and 10 CFR 50.49, and is considered an existing aging management program. The environmental qualification aging management program describes the aging management associated with environmentally qualified electrical equipment within the scope of license renewal. This program is considered a TLAA for license renewal. The TLAA is applicable for EQ components with a qualified life of greater than 40 years. The applicant performed a confirmatory analysis to verify existing analyses were adequate for the period of extended operation. The Environmental qualification program manages component thermal, radiation and cyclical aging based on 10 CFR 50.49(f). The staff reviewed the elements of the program and found them acceptable per 10 CFR 50.49 and 10 CFR 54.21(c)(1). The staff reviewed EQ calculations covering 10 CFR 54.21(c)(i), 10 CFR 54.21(c)(ii), and 10 CFR 54.21(c)(iii). The completion of EQ calculations to extend the qualified life of EQ components is identified as Commitment No. 5 in the staff SER.

3. Summary

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," allows for the renewal of nuclear plant operating licenses for a period up to an additional 20 years. This license renewal rule addresses the safety and technical requirements for extended license term, and the renewal is based on the NRC's assessment of the plant's operational safety, including environmental protection, being assured during the 20-year PEO. The NRC RES has been tasked with identifying and evaluating aging management of SSCs during a SLR period. Among other activities, the work includes an assessment of results from currently implemented license renewal AMPs to obtain a better understanding of the phenomena and management of certain materials degradation mechanisms, and to provide technical information that could be incorporated as lessons learned for a SLR.

Through May 2012, the NRC staff has reviewed and approved 73 reactor units for an additional 20 years of operation beyond the initial license period. As of that same date, the staff is reviewing 9 LRAs for 13 reactor units and expects that essentially all licensees with operating reactors will request an initial license renewal. Furthermore, 15 plants have entered or will enter the PEO beyond 40 years by the end of 2012. Among these plants are the Ginna and NMP-1 NPPs. The renewed operating license for Ginna was issued on May 19, 2004, and the plant entered the period of extended operation beyond 40 years on September 19, 2009. NMP-1 was issued a renewed license on October 31, 2006, and the plant entered the period of extended operation on August 22, 2009.

On-site audits of these two plants were conducted by NRC staff in August/September 2011 for Ginna and November 2011 for NMP-1 to evaluate the implementation and the licensees' assessment of their first renewal AMPs in order to provide guidance for subsequent renewals. The audits at Ginna reviewed 29 AMPs and 1 TLAA in the mechanical area, 8 AMPs and 1 TLAA in the structural area, and 4 AMPs in the electrical area. The NMP-1 audits covered 28 mechanical AMPs and 1 TLAA, 7 structural AMPs and 1 TLAA, and 4 electrical AMPs. The audit process consisted of on-site interviews of licensee plant personnel by NRC staff, with additional participation by telephone by both NRC staff and ANL staff for the mechanical and structural AMPs,. The present report summarizes the observations resulting from the audits of the mechanical and structural AMPs.

The license renewal process for both Ginna and NMP-1 was carried out based on GALL, Rev. 0 guidance, and the AMPs for these two plants were generally prepared in conformance with this guidance. Accordingly, there is not a precise match between the AMPs presently listed in GALL, Rev. 2 and those utilized at these two plants. In addition, because Ginna is a PWR and NMP-1 is a BWR, the applicable AMPs are different for the two plants in some cases. Finally, the AMPs reviewed at Ginna include 3 plant-specific programs not contained in GALL, Rev. 0, all in the mechanical area, and the NMP-1 AMPs include 6 plant-specific programs (2 each in the mechanical, structural, and electrical areas).

The audit team reviewed the licensee's implementation of the AMPs and assessed the licensee observations, including both adverse or unexpected aging as well as confirmatory or anticipated aging. In this review and assessment, particular consideration was given to the following areas:

- accessibility issues, adequacy of inspection methods, and frequency of inspections;
- unanticipated structure and component degradation, related equipment failures, or premature repair/replacement; and
- trending information that can yield insights about the actual effectiveness of the current AMPs and AMRs.

The audit team reviewed information such as the following and completed worksheets to evaluate AMP effectiveness and items of concern for SLR:

- available results of licensee health reports/assessments of the AMPs,

- sample results from the ~~nonconformance reporting system~~Corrective Action Program related to plant aging,
- licensee evaluation of site-specific and industry operating experience,
- changes made to AMPs,
- any related information about the adequacy of current AMPs that will assist in the development of guidance for SLR aging management processes and programs.

Based on these audits the following program strength and good practices were identified:

- The NMP-1 program noted that (a) it performs a quarterly health report that includes a review of the related industry OpE and incorporates the findings into its inspection plans; (b) its risk-informed part of the ISI also requires a review of the OpE.

- At Ginna, monthly self-assessments are performed on both primary and secondary water chemistry as a part of the water chemistry program. With the information obtained, repetitive findings are identified and tracked.

- At Ginna, when leakage is identified within the containment or in an area with enclosed ventilation units, the ventilation units are evaluated for evidence of boric acid deposits.

- Based on the audit at Ginna, the licensee has plans to implement the latest revisions of the Code Cases (not in the GALL Report NUREG-1801, Rev. 2) and track the performance of PWSCC-resistant materials of type Alloy 690 and its welds.

- Ginna considered baffle bolt OpE at DC Cook, Beznau (Switzerland), and Surry and clevis pin insert screw experience from Cook, as well as its plant-specific OpE prior to implementation of its PWR Vessel Internals program.

Notable observations from the audits, which the licensees identified as a result of the various AMPs and have addressed or in the process of addressing, include the following:

- Ginna uprated its power level by 17% at the beginning of Cycle 33, and, during the subsequent Cycle 34, iron transport was slightly higher as indicated by a review of primary and secondary chemistry. During Cycle 34, approximately 89 lbs. of iron oxides were transported by the FW to the steam generators.

- NMP-1 has experienced problems in implementing their HWC, noble metal chemical application, and zinc FW additions programs. These problems in controlling levels, which have been compounded by numerous failures of the computer system that controls the hydrogen addition levels, have resulted in rather wide ECP fluctuations and elevated Co-60 levels in the coolant.

Comment [MRF90]: See Comments MRF 4 and 13.

- The Ginna Reactor Head Closure Studs program is based on NUREG-1339, which recommends a maximum yield strength less than 150 ksi (1034 MPa). This program states that the closure studs are fabricated from SA-320 Gr. L43 (AISI 4340) low-alloy steel with minimum yield strength of 105 ksi (724 MPa), and thus are not susceptible to SCC. However, the Ginna SER stated that it is possible that the studs could have been heat treated to yield strength of 150 ksi (1034 MPa) and could be susceptible to SCC.

Comment [MRF91]: See Comment MRF 7.

- During the NMP-1 spring 2011 refueling outage, EVT-1 of the steam dryer support brackets revealed relevant indications in the HAZ of three of the four brackets (made of high-C A240 Type 304 SS). These indications were identified as IGSCC, possibly due to residual stresses in the weld-sensitized bracket and applied dryer deadweight loads. The licensee recommended re-inspection during the next outage and revision of the flaw evaluation procedure. If no changes in cracking are evident, successive EVT-1 exams will be performed in subsequent outages, and if any significant change in cracking is apparent, a repair will be developed for implementation during the subsequent outage.

- The NMP-1 LRA states that significant FW system nozzle cracking was detected in 1977. A PT examination of one nozzle performed in 1981 showed that no new cracks had initiated since the 1977 inspection and repairs. To minimize the potential for fatigue crack initiation, modifications meeting the requirements NUREG-0619, including cladding removal, improved thermal sleeve/FW sparger design, rerouting of reactor water cleanup piping to the FW line, and improved FW flow control, were completed. Calculations were performed to evaluate stress, fatigue usage, and crack growth of an assumed flaw projected to the end of life of the plant (40 years) as a function of number of operating cycles; these analyses formed the basis for the enhanced ISI program for the FW system nozzle. During the 1999 refueling outage, an in-service UT of the four FW nozzles discovered no reportable indications.

- In addition to the HWC system control problems at NMP-1 noted above, OpE indicates the presence of sulfate spikes due to resin release (intrusions) from demineralizers. These releases have the potential to significantly accelerate SCC of BWR piping.

Comment [MRF92]: See Comment MRF 16.

- NMP-1 OpE indicates that the CRD stub tubes have experienced IGSCC of stub tubes fabricated from furnace sensitized austenitic stainless steel. The licensee indicted that a system leakage test per the ASME Code is performed during every refueling outage, and "best effort inspections" are performed for the stub tubes because they are not accessible during the normal refueling outage activities. The licensee has voluntarily committed to additional inspections of the reactor vessel and internals. During the last eighteen years of operation, cracks and leakage have been detected in the CRD stub tubes using EVT-1 and VT-2 examinations, respectively. Successful repairs of the cracked or leaking stub tubes have been made by roll expanding the CRD housing.

- NMP-1 identified core shroud vertical weld cracking in 1997 following a baseline inspection. A pre-emptive repair was installed in 1999 for the core shroud vertical welds. NMP-1 has also identified indications in the core shroud support H9 vessel attachment weld during baseline BWRVIP-38 inspections in 2001. The indications were analyzed and judged to remain acceptable considering a 10-y re-inspection frequency. A core shroud vertical inspection has demonstrated that no new vertical weld cracking has occurred. However, the severely cracked V9 and V10 welds have continued to grow in depth and are effectively through wall. This condition is bounded by the design assumption used for the vertical weld clamps on V9 and V10.

- The Ginna audit noted that increased roughness was observed at the inner surfaces of OCCW system piping due to the formation of tubercles and other ongoing fouling mechanisms. This impacted the piping internal roughness assumptions used in developing acceptance criteria. Specifically, due to the increased roughness from this aging mechanism, it was determined that the current acceptance criteria established for pressure requirements may not provide sufficient flow through the affected piping in the event of a LOCA. Since this configuration is not tested due to the adverse effects of introducing raw water into the SGs, additional steps may need to be taken to address this aspect.

- The July–Sept. 2011 System Health Report for the Service Water System at NMP-1 noted that the heat exchanger performance was very good, but discussed the condition of the emergency service water piping condition and the need to replace 14-inch discharge piping because of wall thinning. It also noted that much of the small-bore piping is in "a generally degraded condition." As a result, through-wall leaks occur at an "unacceptable" frequency of approximately one per year for 3-inch and smaller diameter piping. Furthermore, the frequency of leaks is increasing.

Comment [MRF93]: See Section 2.3.19 and Comment MRF 30.

- The NMP-1 program basis document for the CCCW system reported numerous incidents of pipe leaks, including seven incidents of pipe wall thinning from 1996 to 2003 and ten occurrences of leakage at threaded and mechanical joints from 2001 to 2003. These failures were attributed to a combination of general, galvanic, and flow-assisted corrosion as well as inadequate design of threaded joints and inadequate wall thickness (schedule 40 rather than the schedule 80 pipe used in replacement). Further investigation revealed multiple problems over the years with maintaining nitrogen overpressure in the system surge tank and with multiple system leaks that required significant system makeup over time. These problems appear to have resulted in higher than specified levels of dissolved oxygen in the CCCW chemistry and consequent corrosion problems.

Comment [MRF94]: See Section 2.3.20 and Comment MRF 31.

- Tuberculation was observed in the NMP-1 fire water branch piping during the flow tests. The tuberculation appears to be a new aging mechanism in the fire water system. The licensee indicated that there are repetitive occurrences of tuberculation and that this is an ongoing issue. Other than tuberculation, degradation reported in CRs in recent years includes obstructions in fire water piping due to corrosion products or silt, through-wall leaks, and pipe thinning.

- Ginna indicated that the last capsule is expected to be withdrawn in about 2018 after exposure to the 80-year-operation fluence level projected for the reactor vessel. It is noted that if Ginna were to continue its operation for a SLR period, it would enter the second license renewal period in 2029, which means that if no additional capsule is reconstituted, Ginna would operate for additional 30 years without a capsule in the reactor vessel. In the broader picture, extended operation beyond 60 years increases the likelihood that a number of licensees will exhaust their supply of surveillance capsules in the reactor vessel. This means that they will increasingly be forced to rely on the alternatives given in GALL AMP XI.M31.

Comment [MRF95]: See Section 2.3.29 and Comment MRF 58.

- As a part of its reactor vessel surveillance AMP, NMP-1 is participating in an integrated surveillance program (ISP) as described in BWRVIP-116. However, it was noted during the audit that the ISP provisions of BWRVIP-116 and BWRVIP-86-A have recently been merged into BWRVIP-86, Rev. 1, which was approved by the NRC in October 2011 and supersedes BWRVIP-116. During the audit interview, NMP-1 personnel indicated that their ISP is being updated to conform to the new guidance in BWRVIP-86, Rev. 1.

- Groundwater leakage problems have also been experienced at NMP-1, where groundwater has entered switchgear and radwaste buildings through below-grade exterior walls and through small (but stable) ground water leaks in some tunnels. Several CRs confirmed minor cracking in concrete structures, including the service water pipe tunnel, allowing leakage of ground water.

- Previous ground water tests in NMP-1 indicate the presence of chlorides greater than 500 ppm, sulfates greater than 1500 ppm, and pH less than 5.5 in some wells. The licensee stated that these aggressive groundwater conditions are localized. NMP-1 has nine wells for groundwater monitoring through routine sampling and analysis of groundwater conditions. The groundwater chemistry is sampled at least once every 6 months for corrosive indicators. It was noted that the GALL recommends the ground water quality monitored on a frequency not to exceed 5 years.

Comment [MRF96]: See Section 2.4.6 and Comment MRF 82.

- ~~The NMP-1 Structures Monitoring AMP implements a plant-specific Wooden Power Pole Inspection Program that manages the aging of wooden power poles that are within the scope of license renewal (i.e., they provide structural support for the transmission lines in the recovery path for SBO). It was noted that the aging management of Wooden Power Pole is not in the GALL report.~~

Comment [MRF97]: See Section 2.4.6 and MRF Comment 80.

- ~~A plant-specific Drywell Supplement Inspection Program has been implemented at NMP-1 that manages aging effects at six localized areas of the drywell shell that have suffered major rusting. This degradation is due to use of chemicals for cleaning the coils of the drywell coolers. This program provides aging management activities for the six localized areas in addition to the activities required by the ASME Section XI ISI (Subsection IWE) Program.~~

Comment [MRF98]: See Section 2.4.10 and Comment MRF 88.

- A plant-specific Torus Corrosion Monitoring Program has also been implemented at NMP-1 to obtain and analyze NMP-1 Torus wall thickness data for use in establishing the torus shell material ongoing corrosion rate and shell wall thickness. The program includes torus UT measurements and torus coupon analysis. The program also provides for visual inspections of the external support structure of the torus. NMP-1 has established the detailed acceptance criteria based on the calculated corrosion rate (mil/years), margin to design thickness (mils), and ~~the projected wall thickness at the end of extended operation~~projects the year at which minimum wall thickness will be reached at the worst case degraded location.

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Comment [MRF99]: Name correction

GINNA AMP (see NUREG-1786 section)	GALL	NRC staff on audit	NRC staff at headquarters	Argonne Support	Ginna POC
Aboveground Carbon Steel Tanks (B2.1.1)	XI.M29	Abdul Sheikh	Herman Graves	David Ma	Michael Canny
ASME Section XI, Subsections IWE and IWL Inservice Inspect (B2.1.3)	XI.S1, XI.S2, XI.S4	Abdul Sheikh	Herman Graves	David Ma	Frank Klepacki, Mark Fitzsimmons
ASME Section XI, Subsections IWB, IWC, and IWD Inservice Inspection (B2.1.2)	XI.M1	Allen Hiser	John Burke	Yogen Garud	Frank Klepacki
ASME Section XI, Subsection IWF, Inservice Inspection (B2.1.4)	XI.S3	Abdul Sheikh	Herman Graves	David Ma	Frank Klepacki
Bolting Integrity (B2.1.5)	XI.M18	Jim Gavula	John Burke	Yogen Garud	Frank Klepacki
Boric Acid Corrosion (B2.1.6)	XI.M10	Allen Hiser	Herman Graves	Omesh Chopra	A.Patrzalek
Buried Piping and Tanks (B2.1.8) and (B2.1.7)	XI.M28	Allen Hiser	Glenn Meyer, Bill Holston	Dwight Diercks	M.Canny
Closed-Cycle (Component) Cooling Water System (B2.1.9)	XI.M21	Jim Gavula	Gene Carpenter	Dwight Diercks	R.Hellems, Ken Kemp
Compressed Air Monitoring (B2.1.10)	XI.M24	Jim Gavula	Herman Graves	Dwight Diercks	M.Bodine
Concrete Containment Tendon Pre-stress (B3.3)	X.S1	Abdul Sheikh	Herman Graves	David Ma	R.Bahai
Electrical Cables and Connections Not Subject to EQ (B2.1.11)	XI.E1	Cliff Doutt	Kenn Miller	NA	David Lovgren
Electric Cables Not Subject to EQ Used in Instrumentation Circuits (B2.1.12)	XI.E2	Cliff Doutt	Kenn Miller	NA	David Lovgren
Environmental Qualification (B3.1)	X.E1	Cliff Doutt	Kenn Miller	NA	David Lovgren
Fatigue Monitoring (B3.2)	X.M1	Seung Min	Jim Medoff	Omesh Chopra	Walter Tono
Fire Protection (B2.1.13)	XI.M26	Amy Hull	Herman Graves	David Ma	Mary Ellen McGraw, Scott Baylor
Fire Water System (B2.1.14)	XI.M27	Amy Hull	Herman Graves, Ganesh Cheruvenki	David Ma	Mary Ellen McGraw, Scott Baylor
Flow-Accelerated Corrosion (B2.1.15)	XI.M17	Jim Gavula	Gene Carpenter, Aloysius Obodoaka	Yogen Garud	A.Guillermo
Fuel Oil Chemistry (B2.1.16)	XI.M30	Allen Hiser	Gene Carpenter, Aloysius Obodoaka	Dwight Diercks	B.Dahl
Heavy & Light Load (Related to Refueling) Handling Syst (B2.1.18)	XI.M23	Bennett Brady	Glenn Meyer	David Ma	Jay Wells, Don ~~Majar~~Magar
Inaccessible Medium-Voltage Cables Not Subject to EQ (B2.1.17)	XI.E3	Cliff Doutt	Kenn Miller	NA	David Lovgren

Comment [MRF100]: Name correction

GINNA AMP (see NUREG-1786 section)	GALL	NRC staff on audit	NRC staff at headquarters	Argonne Support	Ginna POC
Loose Parts Monitoring (B2.1.19)	XI.M14	Amy Hull	Glenn Meyer	Yogen Garud	John Sperr, Kenneth Kemp, Jay Wells, Michael Fallin
Neutron Noise Monitoring (B2.1.20)	XI.M15	Amy Hull	Greg Oberson	Yogen Garud	John Sperr, Kenneth Kemp, Jay Wells, Michael Fallin
One-Time Inspection (B2.1.21)	XI.M32	Jim Gavula	Glenn Meyer	Dwight Diercks	Ken Kemp
Open-Cycle Cooling (Service) Water (B2.1.22)	XI.M20	Jim Gavula	Gene Carpenter	Dwight Diercks	Ben Johns, M.Zweigle
Periodic Surveillance and Preventive Maintenance (B2.1.23)	Plant specific	Bennett Brady	Glenn Meyer	Dwight Diercks	George Herrick, Rod Fett
Protective Coatings Monitoring and Maintenance (B2.1.24)	XI.S8	Amy Hull	John Burke, Herman Graves, Emma Wong, Matt Yoder, Greg Makar	David Ma	Andrew Patrzalek, John Fischer
Reactor Head Closure Studs (B2.1.25)	XI.M3	Seung Min	Greg Oberson	Omesh Chopra	Frank Klepacki
Reactor Vessel Internals (B2.1.27)	XI.M16A	Allen Hiser	Jim Medoff, Ganesh Cheruvenki	Omesh Chopra	J.Wells, R. Marcello, K. Kemp, M.Canny
Reactor Vessel Surveillance (B1.1.28)	XI.M31	Seung Min	Jim Medoff	Dwight Diercks	Damon Peters
Selective Leaching of Materials (B2.1.29)	XI.M33	Bennett Brady	Glenn Meyer	Dwight Diercks	Kenneth Kemp
Spent Fuel Pool Neutron Absorbing Monitoring (B2.1.30)	XI.M22	Allen Hiser	Gene Carpenter, Aloysius Obodoaka, Emma Wong	David Ma	R. Dautel, K. ~~Connor~~Connor
Steam Generator Tube Integrity (B2.1.31)	XI.M19	Seung Min	Greg Oberson, Ken Karwoski	Dwight Diercks	Jay Wells
Structures Monitoring (B2.1.32)	XI.S5, XI.S6, XI.S7	Abdul Sheikh	John Burke	David Ma	Mark Fitzsimmons
System Monitoring (B2.1.33)	Plant specific	Bennett Brady	Glenn Meyer	Dwight Diercks	Jay Wells, D. Markowski
Thermal Aging Embrittlement of CASS (B2.1.34)	XI.M12	Seung Min	Greg Oberson	Omesh Chopra	Michael Fallin
Thimble Tube Inspection (B2.1.36)	Plant specific	Seung Min	Greg Oberson	Yogen Garud	Jay Wells
Water Chemistry Control (B2.1.37)	XI.M2	Amy Hull	Gene Carpenter, Emma Wong	Dwight Diercks	Brian Dahl

NA - Information not available.

Comment [MRF101]: Name correction

Comment [MRF102]: Duplication

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