

ACRS SUBCOMMITTEE MEETING UPDATED LICENSE RENEWAL GUIDANCE DOCUMENTS

Division of License Renewal, NRR

10/22/10

Bob Gramm

NRR/DLR/Aging Management Reactor Systems and
Guidance Updates (RARB)

License Renewal Guidance Document Update Presentation - Agenda



- Background (Bob Gramm/NRR)
- Overview of Standard Review Plan - LR changes (Bob Gramm/NRR)
- Overview of GALL Report changes (Erach Patel/ATL)
- Overview of draft NUREG-1950, technical bases and public comment disposition (Amy Hull/RES)
- Overview changes to electrical aging management programs (Matt McConnell and Cliff Douth/NRR)
- Overview of changes to structural aging management programs (Hans Ashar/NRR)
- Overview of changes to mechanical aging management programs/TLAAs – (Dave Alley and Barry Elliot/NRR and Erach Patel/ATL)

License Renewal Guidance Document Update: Participants



- Involvement of over 90 staff/managers from NRR Div. Of License Renewal, NRR technical divisions, RES, regional staff, and contractors
- 38 staff and managers from NRR/Div. of License Renewal
- 30 staff and branch chiefs from other NRR divisions
 - Including Divisions of: Component Integrity, Engineering, Safety Systems, Inspection and Regional Support, and Risk Assessment
- 16 staff and branch chiefs from multiple RES branches
- 2 Region I staff
- 11 contractors (Advanced Technologies and Laboratories – ATL)
- Expert panels comprised of subject matter experts

License Renewal Guidance Document Update: Stakeholder Interactions



- Extensive interaction with external stakeholders (industry and public)
 - Several NEI comment letters on AMPs and Aging Management Review (AMR) line items in 2009
 - Public workshops in January and May 2010
 - Formal 45 day public comment period in 2010
 - External stakeholder comment letters in 2010
 - Public meetings in 2010, several related to buried piping AMP

License Renewal Guidance Document Update: Background



Focus on Aging Management Program (AMP) content

Items considered for integration into Revision 2:

- Domestic and foreign operating experience (2004-2009)
- Lessons learned from recent LR applications/SERs
- NEI/industry and other external stakeholder comments on GALL Report and SRP-LR
- Material Reliability Program (MRP) 227 input on PWR internals
- Interim Staff Guidance
- New industry guidance and change of regulations

General changes to the Standard Review Plan-LR



General revisions made to SRP-LR

- Revised Appendix A, Section A.1.2.3, AMP Template Elements
- Clarified TLAA Tables 4.1-2 and 4.1-3

Specific revisions to SRP-LR to conform with GALL changes

- Further evaluation sections aligned with GALL Report
- Tables aligned with AMR item changes

Changes to the GALL Report



- Consolidated two volumes of GALL Report into a single volume; all pertinent information was moved into GALL Report and SRP-LR
- Revised Chapter I for application of the ASME Code:
 - AMPs are based on the 2004 Edition of the Code; other editions and addenda are allowed as per the footnote in the GALL Report AMP
 - Clarified use of Code Cases and Relief Requests

Changes to GALL Report - continued



Generic Changes to GALL AMPs

- Added relevant Operational Experience post-GALL 2005
- Updated References to reflect changes post-GALL 2005
- Aligned AMP content with 10-element template for AMPs in the SRP-LR, Appendix A.1
- Added relevant information from recent license renewal applications (LRAs) and precedents
- Updated to ASME Code 2004 Edition and added a footnote
- Preamble added to Chapter XI to provide guidance on the use of later editions/revisions of various industry documents, and to aid applicants in the development of their LRAs

Changes to GALL Report - continued



- Added Chapter VII.E5 for Waste Water System to include liquid waste systems, such as
 - liquid radioactive waste
 - oily waste
 - floor drainage
 - chemical waste water
 - secondary waste water

Changes to GALL Report - continued



A number of AMR Item recommendations for Further Evaluation were changed from “Yes” to “No” based on augmentation of AMP and/or experience. For example:

- Combination of Water Chemistry & One-Time Inspection programs

A number of AMR Items were revised from being managed by a plant-specific AMP to a GALL AMP. For example:

- Neutron absorbing materials other than Boraflex are now managed by AMP XI.M40

NUREG-1950: Disposition of Public Comments and Technical Bases for Revision to LRGDs



- Provides comprehensive bases for revision of NUREG-1800 and NUREG-1801 and disposition of public comments in one volume
- Explains overview of global, generic, or systematic changes
- Analyzes findings from review of operating experience
- Contains NRC staff analysis of public comments received on Rev. 2 drafts
 - Documents disposition of comments accepted by NRC staff and used as basis for instituting a change to either GALL or SRP-LR.
 - Presents technical basis for the staff's disagreement with, and disposition of, those public comments that did not result in a change

Changes to 'Bases Document'

- NUREG 1950 consolidates information comparable to that found earlier in:
 - NUREG-1832, *Analysis of Public Comments on the Revised License Renewal Guidance Documents*, 658 pp, September 2005.
 - NUREG-1833, *Technical Bases for Revision to the License Renewal Guidance Documents*, 718 pp, October 2005.
- Information for public comment disposition and technical bases contained in same document because of closely related content
- More direct linkage between analysis and disposition of public comments (ch. IV) and resulting revisions in GALL(ch. II) and SRP-LR (ch. III)
- More detailed focus on revision of existing AMPs and generation of new AMPs
- Appendix A cross-walks between Rev. 0, Rev. 1, and Rev. 2

AMP XI.E3, Inaccessible Power Cables not Subject to 10 CFR 50.49 EQ Requirements

Significant changes to XI.E3 are based on plant specific and industry operating experience (IN 2002-12), responses to the GL 2007-01, LR inspections and audits, and Division of Engineering and Office of Research input and include:

- *Scope of Work*
 - revised to include all inaccessible or underground power cables greater than or equal to 400 Volts (typically 480 V) within the scope of license renewal subjected to significant moisture
 - revised to include energized and de-energized cables
- *Detection of Aging Effects*
 - revised cable testing frequency not to exceed 6 years
 - revised inspection frequency of water collection is based on plant-specific operating experience, but not to exceed one year
 - event driven water accumulation inspections - such as rain or flood.

AMP XI.E1, Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements

- *Program Description* clarified definition for “adverse localized environment,” and its identification
- Removed references to sampling - all accessible cables in adverse localized environments will be inspected
- Clarified definitions/terminology for consistency within AMP and with other electrical AMPs

AMP XI.E2, Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements Used in Instrumentation Circuits

- *Program Description* consolidated including an updated “adverse localized environment” definition and discussion
- Clarified definitions/terminology for consistency within AMP and with other electrical AMPs

AMP XI.E4, Metal Enclosed Bus

- *Program Description and Scope of Program* revised to include MEB external surfaces and elastomers in AMP XI.E4 with an option to inspect under XI.S6 or XI.M38 as applicable
- *Parameters Monitored/Inspected and Detection of Aging Effects* revised for consistency within AMP and with GALL Chapter VI
- *Detection of Aging Effects* updated sampling criterion
- Clarified definitions/terminology for consistency within AMP and with other electrical AMPs

AMP XI.E5, Fuse Holders

- Revised the aging effect and aging mechanisms for consistency within AMP and with other electrical AMPs
- *Parameters Monitored/Inspected* and *Detection of Aging Effects* revised for consistency within AMP and with GALL Chapter VI
- *Operating Experience* revised to include NUREG -1760 operating experience

AMP XI.E6, Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Requirements

- Incorporated Final License Renewal Interim Staff Guidance LR-ISG-2007-02, which provides for one-time testing
- *Detection of Aging Effects* added sampling criteria
- Clarified definitions/terminology for consistency within AMP and with other electrical AMPs

STRUCTURAL AMPs



- Generic changes for Structural AMPs
 - Structural and high-strength structural bolting moved from Bolting Integrity Program into various structural AMPs
 - AMR line items for structural and high-strength structural bolting now managed by various structural AMPs

AMP XI.S1, ASME Section XI, Subsection IWE

- *Parameters Monitored, Monitoring and Trending, and Corrective Actions* revised AMP to incorporate interim staff guidance (LR-ISG-2006-01) related to monitoring the MK1 drywell corrosion
- *Detection of Aging Effects* revised to augment IWE requirement to include surface examination to detect cracking in SS penetration sleeves, dissimilar metal welds consistent with AMR line item of 2005 GALL Report

Associated AMR line items

- New line added as a result of operating experience for torus shell exposed to air-indoor uncontrolled or treated water with loss of material due to corrosion

XI.S2, ASME Section XI, Subsection IWL and XI.S3, ASME Section XI, Subsection IWF

XI.S2

- *Parameters Monitored* revised to include additional monitoring of tendons when containment cutout is needed to facilitate replacement of steam generator or reactor vessel head

XI.S3

- *Parameters Monitored* clarified to address supports, sliding supports, spring and constant load supports and structural bolting
- *Detection of aging effects* clarified to include aging effects for structural bolting, sliding surfaces, elastomeric vibration isolator elements, and recommend volumetric examination to detect stress corrosion cracking in high strength bolts

AMP XI.S4, 10 CFR 50, Appendix J



- *Detection of Aging Effects* clarified that detection of aging would be achieved with the additional implementation of an acceptable containment inservice inspection program as described in ASME Section XI, Subsection IWE and ASME Section XI, Subsection IWL
- Updated the references to NEI 94-01 Rev 2-A (and associated EPRI Report).

Associated AMR line items

- Revised to separate those components where AMP XI.S4 by itself is applicable (e.g. gaskets not in scope of XI.S1), and components where AMPs XI.S1 and XI.S4 are both applicable

XI.S5, Masonry Walls

- Clarified fire barrier masonry walls covered by Fire Protection
- Added inspection frequency of once every 5 years, or more frequently in areas where significant cracking is observed as defined in ACI-349-3R, edition 1996
- Clarified parameters monitored for cracking, separation, and shrinkage

Associated AMR line items

- Added new AMR line for masonry walls exposed to air-outdoor

XI.S6, Structures Monitoring

- *Scope of Program* revised to:
 - clarify when the applicant has the option to include Masonry Walls and Water Control Structures within the scope of this program
 - include periodic groundwater chemistry (pH, chlorides, and sulfates)
- *Parameters Monitored* revised to clarify parameters to be monitored for concrete, steel, structural bolting, structural sealants, elastomeric vibration isolators, groundwater chemistry, and settlement monitoring
- *Detection of Aging Effects* revised recommended inspection frequency:
 - In-scope structures – stipulated in ACI-349-3R, edition 1996
 - Settlement monitoring – plant specific operating experience
 - Groundwater chemistry – not to exceed five years

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



- *Program Description* clarified that dam inspection is not in scope
- *Scope of Program* clarified to include sluice gates and trash racks
- *Detection of Aging Effects* added provisions to address aging effects based on groundwater chemistry

Associated AMR line items

- Added new line for wooden piles in air-outdoor or water flowing or standing, or groundwater/soil

XI.S8 Protective Coating Monitoring and Maintenance

- Updated ASTM Standards
- Clarified importance of coating assessments for ECCS performance
- *Scope of Program* clarified to include coatings on concrete so that all coatings in containment are addressed
- Revised reference to RG 1.54, Revision 2
- New AMR line added in Chapters II and III for loss of coating integrity due to blistering, cracking, flaking, peeling, physical damage

MECHANICAL AMPs

- Added three new AMPs
 - Chapter XI.M16A, “PWR Vessel Internals”
 - Chapter XI.M40, “Monitoring of Neutron-Absorbing Materials Other than Boraflex”
 - Chapter XI.M41, “Buried and Underground Piping and Tanks”
- Deleted two AMPs due to lack of relevance
 - Chapter XI.M14, “Loose Part Monitoring”
 - Chapter XI.M15, “ Neutron Noise Monitoring”

MECHANICAL AMPs

- Eliminated three AMPs because they were subsumed by others
 - Chapter XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS),” is subsumed by Chapter XI.M9, “BWR Vessel Internals” and the new Chapter XI.M16A, “PWR Vessel Internals”
 - Chapter XI.M28, “Buried Piping and Tanks Surveillance,” and Chapter XI.M34, “Buried Piping and Tanks Inspection,” are subsumed by the new Chapter XI.M41, “Buried and Underground Piping and Tanks”

MECHANICAL AMPs

- **Changes to various AMPs including:**
 - Chapter XI.M11B, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRs Only)”
 - Chapter XI.M21A, “Closed Treated Water Systems”
 - Chapter XI.M31, “Reactor Vessel Surveillance”
 - Chapter XI.M35, “One-Time Inspection of ASME Code Class 1 Small-Bore Piping”
 - Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”
 - Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”

AMP XI.M41

Buried and Underground Piping and Tanks

Objective

- Manage aging of buried and underground piping and tanks
 - Primary issue is external corrosion

AMP XI.M41

Buried and Underground Piping and Tanks

Definitions

- Buried
 - In direct contact with soil or concrete
- Underground
 - Below grade
 - Limited access
 - In contact with air
 - e.g. pipes in trenches or vaults

AMP XI.M41

Buried and Underground Piping and Tanks

Philosophy

- Preventive actions are the best approach to aging management
 - Some inspections still required
 - More inspections required if prevention is less than perfect
- Concentrate efforts on high “risk” pipe
 - Higher probability of corrosion
 - Code Class or safety related
 - Hazmat
 - Radiation, diesel fuel etc.

AMP XI.M41

Buried and Underground Piping and Tanks

Philosophy, contd.

- Design preventive actions and inspections to prevent adverse effects
 - Code class/safety related
 - Must have sufficient water flow
 - Hazmat
 - Must not contaminate groundwater
- Excavations can damage pipe
 - Permit alternatives to excavations whenever possible
 - Hydrotests
 - Internal inspections
 - Monitor active equipment (jockey pumps)

AMP XI.M41

Buried and Underground Piping and Tanks

Preventative Actions

- Applies to all piping except for fire mains
- Separate recommendations for
 - Buried piping and tanks
 - Underground piping and tanks
- Based on material of construction
- Recommendations concerning
 - Coating
 - Backfill
 - Cathodic protection

AMP XI.M41

Buried and Underground Piping and Tanks

Preventative Actions, contd.

Material ¹	Coating ²	Cathodic Protection ⁴	Backfill Quality
Titanium			
Super Austenitic Stainless ⁸			
Stainless Steel	X ³		X ^{5, 7}
Steel	X	X	X ⁵
Copper	X	X	X ⁵
Aluminum	X	X	X ⁵
Cementitious or Concrete	X ³		X ^{5, 7}
Polymer			X ⁶

AMP XI.M41

Buried and Underground Piping and Tanks

Inspections

- Categories considered
 - Buried pipe
 - Underground pipe
 - Buried tanks
 - Underground tanks
- Each category addressed separately
- Apply to
 - Code Class/safety related
 - Hazmat
- Expand to
 - All piping

AMP XI.M41

Buried and Underground Piping and Tanks

Inspections, contd.

- Designed to accommodate
 - Poor prevention in first inspection (yrs 30-40)
- Expect
 - Good prevention in remaining inspections

AMP XI.M41

Buried and Underground Piping and Tanks

Inspections, contd.

Material ¹	Preventive Actions ²	Inspections ³	
		Code Class Safety Related ⁴	Hazmat ⁵
Titanium			
Super Austenitic Stainless ⁷			
Stainless Steel		1 ⁶	1 ⁶
HDPE ⁸	A	1 ⁶	1 ⁶
	B	2	1%
Other Polymer ⁹	A	1 ⁶	1 ⁶
	B	2	1%
Cementitious or Concrete Steel		1 ⁶	1 ⁶
	C	1 ⁶	1 ⁶
	D	1	2%
	E	4	5%
	F	8	10%
Copper	C	1 ⁶	1 ⁶
	D	1	1%
	E	1	2%
	F	2	5%
Aluminum	C	1 ⁶	1 ⁶
	D	1	2%
	E	1	5%
	F	2	10%

AMP XI.M41

Buried and Underground Piping and Tanks



Inspections, contd.

Material ¹	Preventive Actions ²	Inspections ³	
		Code Class Safety Related ⁴	Hazmat ⁵
Steel	C D E F	1 ⁶ 1 4 8	1 ⁶ 2% 5% 10%

AMP XI.M41

Buried and Underground Piping and Tanks

Inspections, contd.

- Alternatives
 - Fire mains
 - Flow tested at 1 year intervals
 - Monitor jockey pump activity
 - All pipe
 - Hydrostatic tests
 - Internal inspections

AMP XI.M41

Buried and Underground Piping and Tanks

Summary

- Intent is to manage aging
 - Best accomplished through preventive actions
 - Necessary preventive actions depend on material and environment
- Intent is to be consistent with the way other high priority buried pipe is managed
 - Oil and gas pipelines
 - NACE SP0169-2007 critical component
- Concentrate on important piping
 - Code Class/safety related
 - Hazmat
 - Level of inspection differs

AMP XI.M41

Buried and Underground Piping and Tanks

Summary, contd.

- Inspections necessary
 - Level depends on material and prevention
 - Good prevention by second inspection
 - Alternatives to visual inspections provided

AMP XI.M16A, PWR Vessel Internals



- AMP is based on guidelines for examination of vessel internals in EPRI report, “Materials Reliability Program (MRP): Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-Rev. 0)” and “MRP: Inspection Standard for PWR Internals (MRP-228)”
- MRP-227-Rev.0 is currently being reviewed by the NRC staff

AMP XI.M16A, PWR Vessel Internals - continued



- MRP submitted proposed AMR line items for Westinghouse, Combustion Engineering, and Babcock and Wilcox designed vessel internals, based on MRP-227-Rev.0
- GALL 2005 did not contain a generic AMP for PWR vessel internals:
 - GALL 2005 recommended applicants to commit to participate, evaluate and implement an industry program for vessel internals and to provide an inspection plan no less than 24 months before entering the period of extended operation
 - GALL 2010 recommended applicants submit an inspection plan for vessel internals to the NRC for review and approval with the application for license renewal

AMP XI.M16A, PWR Vessel Internals - continued



- NRC staff modifications to the proposed MRP AMR line items:
 - Cracking to be managed by AMPs XI.M2, “Water Chemistry,” and XI.M16A, “PWR Vessel Internals”
 - All other aging effects to be managed by AMP XI.M16A, “PWR Vessel Internals”
 - Each component that is classified as a primary component, expansion component, or an existing program component in accordance with MRP-227-Rev.0 to be included in GALL
 - Cross reference primary and expansion component in accordance with MRP-227-Rev.0

AMP XI.M16A, PWR Vessel Internals - continued



- NRC staff modifications to the proposed MRP AMR line items (contd.):
 - All aging effects and components identified as primary, expansion, or existing program components in Table 3-1 through 3-3 of MRP-227-Rev.0 are identified as AMR line items in GALL – staff observed discrepancies between tables in section 3 and section 4 of MRP 227
 - Components that are identified as “no additional measures” components are not uniquely identified in the GALL tables
 - Core support structures will be examined in accordance with AMP Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD”

AMP XI.M16A, PWR Vessel Internals - continued



- NRC staff modifications to the proposed MRP AMR line items (contd.):
 - Further evaluation of inaccessible locations if cross referenced accessible primary, expansion or existing program components have aging effects that need aging management
 - Further evaluation of Westinghouse guide tube support pins in control rod guide tube assemblies and Combustion Engineering lower incore instrumentation (ICI) thimble tubes
 - TLAA for further evaluation is identified for reduction in ductility and fracture toughness due to neutron irradiation for Babcock & Wilcox reactor vessel internals

Chapter X.M1, “Fatigue Monitoring”

- Updated relative to background basis, assumptions, background information on how the program is applied, and basis for environmental fatigue calculations
- Update provides specific guidance for calculating environmentally-adjusted cumulative usage factor for carbon and low alloy steels, austenitic stainless steels, and nickel alloys
- Clarifies that scope includes locations identified in NUREG/CR-6260 as a minimum, and additional plant-specific component locations if they may be more limiting than those considered in NUREG/CR-6260
- Clarifies to provide a clear basis on how the tracking of the cycles (the preventive parameter) can be used to ensure the validity of current design basis CUF fatigue analysis values

TLAAs - SRP-LR Section 4.3, “Metal Fatigue”

- Clarified 10 CFR 54.21(c)(1)(i), (ii), and (iii) acceptance criteria and review procedure criteria for all Section 4.3 subsections
- Consolidated recommendations for implicit fatigue analyses that are applicable to ANSI B31.1 components and ASME Code Class 2 and 3 components designed to Section III requirements
- Added sections for SRP-LR review acceptance criteria and review procedures for metal fatigue TLAAs that may be applicable to BWR vessel internal components and for potential fatigue flaw growth analyses

License Renewal Guidance Document Update: Summary



- Involvement of NRC subject matter experts from multiple organizations
- Extensive interaction with, and incorporated comments from external stakeholders
- Changes made based on operating experience
- Incorporation of many lessons learned from license renewal applications and associated staff reviews
- Enhancements made to the GALL Report and SRP-LR that will improve their usefulness by staff and industry
- Guidance documents will provide appropriate framework for applicant's to develop programs that will continue to provide reasonable assurance to manage aging effects
- Requested waiver of CRGR review pending