UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATIONS
WASHINGTON, DC 20555-0001

July 1, 2011

NRC REGULATORY ISSUE SUMMARY 2011-05 INFORMATION ON REVISION 2 TO THE GENERIC AGING LESSONS LEARNED REPORT FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

ADDRESSEES

All holders of a power reactor operating license under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

INTENT

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to provide information to applicants and licensees on the changes to NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 2, issued December 2010.

The purpose of this RIS is to inform applicants and licensees, especially those with license renewal applications currently under review and those with a renewed operating license, of operating experience incorporated since the previous revision to the GALL Report and the associated changes to staff positions concerning adequate aging management of structures, systems, and components within the scope of license renewal.

This RIS does not discuss all the Revision 2 changes; instead, it identifies the more noteworthy modifications that the staff has evaluated as important to ensure that the effects of aging at nuclear power plants are adequately managed so that structure, system, and component functions are maintained during the period of extended operation. Revision 2 of the GALL Report identifies all the changes.

This RIS requires no specific action or written response. The NRC recommends that licensees review the recently issued changes to Revision 2 of the GALL Report. It also encourages licensees with renewed operating licenses to review the changes to the GALL Report and consider actions necessary to incorporate these updates, as appropriate, into existing aging management programs (AMPs) at their plants.

BACKGROUND INFORMATION

NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), Revision 2, issued December 2010, references NUREG-1801 as a

technical basis document. The GALL Report lists generic aging management reviews of systems, structures, and components that may be in the scope of license renewal applications and identifies aging management programs (AMPs) that the NRC finds acceptable for managing the aging effects expected during a plant's operation past the expiration date of its original license (i.e., the period of extended operation). The NRC staff uses the GALL Report as a basis for review of license renewal applications consistent with guidance in the SRP-LR.

The NRC staff issued Revision 2 to the GALL Report in December 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML103490041). The changes incorporate (1) lessons learned from the reviews of previous license renewal applications, (2) operating experience obtained after the NRC issued Revision 1 to the GALL Report, and (3) other public input, including industry comments. The staff from the Division of License Renewal (DLR) analyzed operating experience information during a screening review of domestic operating experience, foreign operating experience from the international Incident Reporting System database, and NRC generic communications. The information reviewed included operating experience from January 2004 to approximately April 2009.

SUMMARY OF ISSUE

This document provides an overview of noteworthy changes identified by the NRC staff in Revision 2 of the GALL Report and a useful synopsis to help licensees and applicants understand the significant differences between Revision 1 and Revision 2. Licensees and applicants should review Revision 2 for details on programmatic changes and other aging management information that may apply to specific plants.

This RIS is also meant as a reminder of the significance of aging-related operating experience and of the value that the NRC staff places on this information. Aging-related operating experience was a fundamental consideration in the development of the GALL Report, and it continues to play a key role in revisions to the document. Furthermore, the GALL Report and the SRP-LR state that the staff's evaluation of a license renewal application in determining the adequacy of AMPs is based, in part, on the applicant's consideration of, and its actions taken to address, both plant-specific and industry operating experience.

As discussed in the GALL Report, each AMP includes 10 elements. Element 10, "Operating Experience," states the following:

> Operating experience involving the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support a determination that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation.

Since the issuance of Revision 1 of the GALL Report, some applicants have committed to evaluate plant-specific and appropriate industry operating experience and to incorporate lessons learned to assess aging effects for new programs. The staff finds that these commitments have merit and has revised the SRP-LR to clarify its expectations.

Section A.1.2.3.10, "Operating Experience," of Appendix A, "Branch Technical Positions," to Revision 2 of the SRP-LR states the following:

> For new AMPs that have yet to be implemented at an applicant's facility, the programs have not yet generated any operating experience (OE). However, there may be other relevant plant-specific OE at the plant or generic OE in the industry that is relevant to the AMP's program elements even though the OE was not identified as a result of the implementation of the new program. Thus, for new programs, an applicant may need to consider the impact of relevant OE that results from the past implementation of its existing AMPs that are existing programs and the impact of relevant generic OE on developing the program elements. Therefore, operating experience applicable to new programs should be discussed. Additionally, an applicant should commit to a review of future plant-specific and industry operating experience for new programs to confirm their effectiveness.

After the NRC issues a renewed license, licensees continue to (1) review industry, foreign, and plant-specific operating experience, (2) evaluate its applicability, and (3) incorporate appropriate changes in accordance with Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 and 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The NRC revised the SRP-LR to provide guidance on applying operating experience associated with systems, structures, and components that are within the scope of license renewal. Section A.1.2.3.10 in Revision 2 of the SRP-LR states the following:

> Reviews of operating experience by the applicant in the future may identify areas where aging management programs should be enhanced or new programs developed. An applicant should commit to a future review of plant-specific and industry operating experience to confirm the effectiveness of its aging management programs or indicate a need to develop new aging management programs.

NRC inspectors routinely evaluate licensee corrective action and operating experience review programs as part of the Reactor Oversight Process (Inspection Manual Chapter 0310, "Components within the Cross-Cutting Areas," and Inspection Procedure 71152, "Problem Identification and Resolution").

The following summarizes the significant updates to aging management guidance, detailed in Revision 2 of the GALL Report:

- Fatigue Monitoring. The revised scope of AMP X.M1, "Fatigue Monitoring," now includes all components with a fatigue time-limited aging analysis and updated specific guidance for calculating environmentally adjusted cumulative usage factors for different materials.

The revision also clarifies the scope to include locations identified in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," issued February 1995, as a minimum, and additional plant-specific component locations if they may be more limiting than those considered in NUREG/CR-6260.

- Reactor Head Closure Stud Bolting. The revision to AMP XI.M3, "Reactor Head Closure Stud Bolting," updates the program to include the more appropriate yield strength designation for high-strength bolts, which reflects information in the reference document, NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," issued June 1990. In addition, the revision specifically identifies that molybdenum disulfide is a potential contributor to stress corrosion cracking and should not be used.

- Boiling-Water Reactor (BWR) Vessel Internals. The revision to AMP XI.M9, "BWR Vessel Internals," added the technical contents of the current AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steels (CASS)"; referenced the new BWR Vessel Internals Program (BWRVIP) reports; and updated the existing BWRVIP reports. Additionally, the program scope added the thermal aging and neutron irradiation embrittlement of precipitation-hardened martensitic stainless steel and martensitic stainless steel and the irradiation embrittlement of X-750 alloy in the BWR reactor vessel.

- Cracking of Nickel-Alloy Components and Loss of Material due to Boric-Acid-Induced Corrosion. AMP XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRs Only)," supersedes AMP XI.M11A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors (PWRs only)," and AMP XI.M11, "Nickel-Alloy Nozzles and Penetrations." AMP XI.M11B recognizes the industry's Materials Reliability Program (MRP) MRP-139, "Materials Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guideline," for the inspection of dissimilar metal welds in the primary system. It also recognizes Code Cases N-791 and N-722 of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) for nickel-alloy components that NRC regulations now mandate.

- Pressurized-Water Reactor (PWR) Vessel Internals. AMP XI.M16A, "PWR Vessel Internals," reinstates the vessel internals AMP which is based on MRP-227, "Pressurized Water Reactor Internals Inspection and Evaluation Guidelines." The staff's final safety evaluation on MRP-227 was issued on June 22, 2011. The staff also plans to issue a RIS that provides information on the implementation of MRP-227 for license renewal and will issue an interim staff guidance document to make conforming changes to the GALL Report.

- Steam Generators. AMP XI.M19, "Steam Generators," includes extensive revisions to reflect Nuclear Energy Institute 97-06, "Steam Generator Program Guidelines," Revision 2, issued May 2005, and adds aging management review line items to ensure adequate aging management of divider plate assemblies and to provide consistency between once-through steam generators and recirculating steam generators for tube to tubesheet welds.

- One-Time Inspection and Selective Leaching. The revision to AMP XI.M32, "One-Time Inspection," and AMP XI.M33, "Selective Leaching," provides additional details on sample sizes for these programs.

- One-Time Inspection of ASME Code Class 1 Small-Bore Piping. The revision to AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small Bore-Piping," explicitly includes aging management of socket welds, allows for destructive examinations of these welds, and recognizes that advances in ultrasonic testing may make volumetric examinations of socket welds more effective. The revised program describes conditions under which this one-time inspection is appropriate and explains when a periodic inspection program would be more appropriate. The program revision includes guidance on the number of welds to be inspected that represents a sufficient number of locations to ensure an adequate sample and on the implementation schedule of the one-time inspections.

- External Surfaces Monitoring of Mechanical Components and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting. The revisions to AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," and AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," increase the scope of materials covered to include all metallic and polymeric components. The NRC revised the scope of aging effects to include loss of material for all metallic materials and changes in material properties for polymeric materials. The revised AMPs provide details of the examination of polymeric materials using manual manipulation, provide acceptance criteria for nonmetallic materials, and better define the acceptance criteria for metallic materials.

- Flux Thimble Tube Inspection. The revision to AMP XI.M37, "Flux Thimble Tube Inspection," clarifies that this program is a condition-monitoring program, not an inspection program. It also clarifies the scope of program terminology by stating that the instrument guide tubes are not in the scope of this program (instrument guide tubes are managed by the inservice inspection, water chemistry, and nickel-alloy AMPs). Finally, the NRC revised the "monitoring and trending" and "acceptance criteria" elements to clarify that licensees must base their examination frequencies and calculated wear rates on actual plant-specific wear data. To this end, a methodology that includes sufficient conservatism is necessary to ensure that acceptance criteria continue to be met between scheduled inspections.

- Neutron-Absorbing Materials Other than Boraflex. New AMP XI.M40, "Monitoring of Neutron-Absorbing Materials Other than Boraflex," is a monitoring program for each neutron-absorbing material credited for criticality control in the spent fuel pool (other than Boraflex, which is managed by the boraflex monitoring AMP). AMP XI.M40 implements LR-ISG-2009-01, "Aging Management of Spent Fuel Pool Neutron-Absorbing Materials Other than Boraflex," issued April 2010.

- Buried Piping and Tanks. The GALL Report now combines the previous buried piping and tanks surveillance program (AMP XI.M28) and the buried piping and tanks inspection program (AMP XI.M34) to create a new program, AMP XI.M41, "Buried and Underground Piping and Tanks," that incorporates aspects of both of the previous programs.

  AMP XI.M41 increases the number of materials covered and recommends cathodic protection for all materials covered by National Association of Corrosion Engineers Standard Practice (SP)0169-2007, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems," including steel, cast iron, copper, and aluminum. This new AMP better defines inspection programs that vary based on plant-specific factors, such as the quality of backfill around the piping and the use of cathodic protection.

- Subsection IWE of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the ASME Code. The revision to AMP XI.S1, "ASME Section XI, Subsection IWE," incorporates LR-ISG-2006-01, "Plant-Specific Aging Management Program for Inaccessible Areas of Boiling Water Reactor Mark I Steel Containment Drywell Shell," issued 2006, related to the monitoring of Mark 1 drywell corrosion. The revision also augments the requirements in Subsection IWE to include surface examinations to detect cracking in stainless steel penetration sleeves, dissimilar metal welds, and steel components that are subject to cyclic loading but have no current licensing-basis fatigue analysis.

- Masonry Walls. The revision to AMP XI.S5, "Masonry Walls," includes changes that better define degradation parameters. AMP XI.S5 also establishes an inspection frequency of every 5 years (or more frequent if cracking is observed) instead of the previous recommendation that was based on plant-specific operating experience.

- Structures Monitoring Program. The revision to AMP XI.S6, "Structures Monitoring," includes a new recommended frequency of inspections for the in-scope structures, settlement monitoring, and inaccessible below-grade concrete. In addition, the revision includes provisions for monitoring ground water chemistry, clarifies the use of relevant codes and standards, and incorporates monitoring criteria for structural bolting and elastomeric vibration isolation elements. Applicants that are not committed to American Concrete Institute (ACI) Standard 349.3R and that elect to use plant-specific criteria for concrete structures should describe the criteria and provide a technical basis for deviations from those in ACI Standard 349.3R.

- Protective Coating Monitoring and Maintenance. The revision to AMP XI.S8, "Protective Coating Monitoring and Maintenance Program," emphasizes the importance of coating assessments for emergency core cooling system performance. The NRC increased the scope of the program to include coatings on concrete in order to address all Service Level 1 (at a minimum) coatings in containment.

- Inaccessible Power Cables Not Subject to the Environmental Qualification Requirements in 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants." The revision to AMP XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," increases the scope to include 400-volt and above power cables. It also revises cable test frequencies to at least once every 6 years, deemphasizes the degradation mechanism associated with "water treeing," and recommends consideration of water intrusion. The program also removes the exclusion allowance of removing from scope those cables that are energized 25 percent of the time or less. The program revision increases periodic manhole inspection frequencies to at least annually, incorporates event-driven inspections (heavy rain or flood events), and clarifies cable testing and manhole inspection actions.

In summary, the NRC recommends that licensees review the recently issued changes to Revision 2 of the GALL Report. It also encourages licensees with renewed operating licenses to review the changes to the GALL Report and consider actions necessary to incorporate these updates, as appropriate, into existing AMPs at their plants. Any licensee planning to submit a license renewal application for renewal should consider the latest revision to the GALL Report that is in effect at the time of submittal. The latest revision to the GALL Report can be found under ADAMS Accession No. ML103490041 and at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1801/r2/.

BACKFIT DISCUSSION

This RIS requires no action or written response. Any action on the part of addressees to update existing AMPs in accordance with the guidance that appears in this RIS or in Revision 2 to the GALL Report is strictly voluntary. Therefore, this RIS does not constitute a backfit under 10 CFR 50.109, "Backfitting," and the staff did not perform a backfit analysis.

FEDERAL REGISTER NOTIFICATION

The NRC did not publish a notice of opportunity for public comment on this RIS in the *Federal Register* because the RIS is informational and because the agency has worked closely with industry representatives from the Nuclear Energy Institute, members of the public, and other stakeholders over a period of time on the development of Revision 2 of the GALL Report. As appropriate, the NRC has solicited public comment on proposed activities and a draft version of the GALL Report in the *Federal Register* and at public meetings.

The schedule for the development of Revision 2 to the GALL Report can be found at http://www.nrc.gov/reactors/operating/licensing/renewal/guidance/updated-guidance.html. This site lists the dates of milestones, including public meetings and requests for comments, that the agency met in the development of this revision to the GALL Report.

CONGRESSIONAL REVIEW ACT

The NRC has determined that this action is not a rule as designated by the Congressional Review Act (5 U.S.C. 801-808) and, therefore, is not subject to the Act.

PAPERWORK REDUCTION ACT STATEMENT

This RIS does not contain new or amended information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). The Office of Management and Budget (OMB) approved existing information collections under OMB control numbers 3150-0011 and 3150-0155.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

CONTACT

Please direct any questions about this matter to the technical contact listed below.

/RA by Robert A. Nelson for/

Timothy J. McGinty, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contact: Lisa M. Regner, Senior Project Manager
NRR/DLR/RPB2
(301) 415-1906
E-mail: lisa.regner@nrc.gov

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OFFICE	LA: NRR/DLR*	NRR/DLR/RPB2	Tech Editor*	NRR/DLR/RPB2	NRR/DLR/RAPB*
NAME	SFigueroa	LRegner	KAzariah-Kribbs	DWrona	DPelton
DATE	04/26/2011	04/26/2011	05/04/2011	05/04/2011	05/16/2011
OFFICE	NRR/DLR/RASB	NRR/DLR/RARB	NRR/DLR	NRR/DORL	OE*
NAME	RAuluck	ADias	BHolian	JGiitter	NHilton
DATE	05/ 24/2011	05/16/2011	05/05/2011	05/ 19/2011	05/19/2011
OFFICE	NRR/PMDA*	OIS*	OGC/NLO	LA: NRR/DPR	NRR/DPR/PGCB
NAME	LHill	TDonnell	SUttal	CHawes CMH	LBanic
DATE	05/18/2011	05/24/2011	06/ 07/2011	06/29/2011	06/29/2011
OFFICE	NRR/DPR/PGCB	NRR/DPR			
NAME	SRosenberg	TMcGinty RANelson for			
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