



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

September 1, 2022

MEMORANDUM TO: Lauren Gibson, Chief  
License Renewal Projects Branch  
Division of New and Renewed Licenses  
Office of Nuclear Reactor Regulation

FROM: Brian Harris, Senior Project Manager /RA/  
Marieliz Johnson, Project Manager  
Licensing Renewal Projects Branch  
Division of New and Renewed  
Licenses Office of Nuclear Reactor  
Regulation

SUBJECT: AUDIT PLAN FOR THE REGULATORY AUDIT OF THE NEI-  
PROPOSED AGING MANAGEMENT PROGRAM REVISION TO  
SELECTIVE LEACHING PROGRAM (XI.M33)

On January 12, 2022, Nuclear Energy Institute (NEI) submitted marked up Aging Management Program (AMP) for Limerick's Selective Leaching pilot program. (Agencywide Documents Access and Management System Accession No. [ML22019A291](#)).

The purpose of the subject audit, to be conducted by the NRC staff, is to review the supporting documentation to the pilot implementation of sampling methodology and establish an understanding of technical basis of all changes in order to conclude the adequacy of the proposed revised AMP.

The audit will review information on the licensee's electronic reading room. The audit is currently scheduled to begin on September 15, 2022, and end on October 13, 2022. The audit plan is enclosed.

Enclosure:  
As stated

cc w/encl.: Listserv

CONTACT: Brian Harris  
301-415-2277

SUBJECT: AUDIT PLAN FOR THE REGULATORY AUDIT OF THE NEI-PROPOSED AGING  
MANAGEMENT PROGRAM REVISION TO SELECTIVE LEACHING PROGRAM  
(XI.M33) DATED: SEPTEMBER 1, 2022

DISTRIBUTION:

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**ADAMS Accession No:ML22244A083**

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**U.S. NUCLEAR REGULATORY COMMISSION**  
**REGULATORY AUDIT OF THE NEI-PROPOSED AGING MANAGEMENT PROGRAM**  
**REVISION TO SELECTIVE LEACHING PROGRAM (XI.M33)**

**I. BACKGROUND**

On January 12, 2022, NEI submitted marked up AMPs for Limerick's Selective Leaching and Callaway Plant's Inaccessible Power Cables ([ML22019A291](#)) pilot programs. The proposed NEI revisions are being considered for incorporation into the next GALL-SLR update, currently in process. A Public Meeting was held on June 2, 2022, with NEI, EPRI, & industry to discuss the NEI-proposed revisions. Staff's initial thoughts are that more detailed explanation (and technical basis) within the AMPs is needed to support this transformative approach as communicated during industry presentations.

**II. REGULATORY AUDIT BASIS**

License renewal requirements are specified in Title 10 of the Code of Federal Regulations (10 CFR), Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." Guidance is provided in NUREG-2192, Rev. 0, "Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants," (SRP-SLR) dated July 2017, and NUREG 2191, Rev. 0, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report," dated July 2017.

NUREG-2191 provides guidance for SLR applicants. The GALL-SLR Report contains the staff's generic evaluation of plant aging management programs (AMPs) and establishes the technical basis for their adequacy. The GALL-SLR Report contains recommendations on specific areas for which existing AMPs should be augmented for SLR. An applicant may reference this report in an SLR application to demonstrate that the AMPs at the applicant's facility correspond to those described in the GALL-SLR Report. If an applicant credits an AMP in the GALL-SLR Report, it is incumbent on the applicant to ensure that the conditions and operating experience (OE) at the plant are bounded by the conditions and OE for which the GALL-SLR Report program was evaluated.

**III. REGULATORY AUDIT SCOPE**

The scope of this audit focuses on areas where the NRC staff needs to observe implementation of sampling methodology (along with specific areas included below) and establish an understanding of technical basis of all changes in order to determine the adequacy of the proposed revised AMPs.

#### IV. INFORMATION AND OTHER MATERIAL NECESSARY FOR THE REGULATORY AUDIT

The documents that support the information below (and additional technical topics identified during the audit) are requested to be added on the licensees' electronic reading room:

- **XI.M33 Selective Leaching (Limerick Pilot Revision)** Technical Basis for:
  - o Aging Mechanism Uncertainties. EPRI 3002016057, "Selective Leaching State-of-the-Art Technical Update," cites "notable technical gaps" regarding:
    - Impact of different environmental chemistry parameters (e.g., pH, resistivity / conductivity, halide concentrations, oxygen content) on selective leaching rates and overall susceptibility
    - effects that alloying elements may have on cast iron susceptibility.
    - corrosion behavior of different iron matrix structures (ferrite, pearlite, martensite) and effects of trace metals, which may be present from the casting process, on susceptibility
    - conflicting studies regarding the effects of the flake graphite network in gray cast iron as it relates to susceptibility
    - introduction of additional failure modes (e.g., crack initiation points) resulting from selective leaching
    - likelihood impact for flow rates on copper alloy differ between EPRI 3002016057 and EPRI 3002020623, Appendix A.
  - o Malleable Iron. Operating experience involving a recent SLRA applicant in 2020 identified graphitic corrosion on the internal surfaces of malleable iron fittings exposed to closed cycle cooling water (ADAMS Accession Nos. ML21327A279 and ML22010A129). Based on this new operating experience, the staff is considering including malleable iron as a material type susceptible to selective leaching in the next revision to the GALL-SLR Report. The staff requests a technical basis for why the proposed NEI revision to GALL-SLR AMP XI.M33, "Selective Leaching," does not include malleable iron as a material type susceptible to selective leaching.
  - o Inspection Sample Size Reduction. The extent of inspections for selective leaching during the subsequent period of extended operation (i.e., 3 percent with a maximum of 10 components per GALL-SLR guidance) was reduced when compared to the extent of inspections for selective leaching during the initial period of extended operation. The NEI document proposes a further reduction down to 2-3 components per population without a technical basis.
  - o Re-Introduction of Hardness Testing. Hardness testing was replaced with mechanical examination techniques and destructive examinations with the issuance of GALL-SLR. The NEI document proposes re-introducing hardness testing without a technical basis. Hardness testing can theoretically identify the presence of selective leaching but is unable to characterize the extent of selective leaching.
  - o Credit for Undefined Future NDE Techniques. The NEI document introduces "[n]ondestructive examination techniques demonstrated to be capable of detecting the presence and/or extent of selective leaching on the component" as an inspection method. The AMP should identify specific NDE techniques which are capable of detecting selective leaching in cast irons and copper alloys. Staff noted that NDE for selective leaching has not achieved widespread acceptance.
  - o Reliance on One Inspection Technique. GALL-SLR Report AMP XI.M33 recommends visual/mechanical and destructive examinations for each

population. The NEI proposal states “[i]nspections and examinations may consist of any [of] the following methods” (referring to either visual/mechanical, hardness, nondestructive, or destructive examinations). A basis is needed for going from two inspections techniques in our current guidance down to one inspection technique.

- Samples Based on Consequence. When using the risk-informed sampling methodology, inspections focus on consequence, not likelihood (see second bullet in section A.7 of EPRI 3002020713 or the sampling requirements in the proposed revision to AMP XI.M33).
  - How is susceptibility to selective leaching considered while using this methodology?
  - Provide the technical basis for the likelihood values used and the exclusion of likelihood from the minimum samples.
  - The methodology used to determine risk/consequence appears to be a new method, especially when the components being reviewed have not been categorized in accordance with 10 CFR 50.69. Has this methodology been peer reviewed or accepted? Will this methodology be applied if the licensee does not have an approved 50.69 license amendment or the majority of components have not been categorized?
  - Provide the technical basis for using the PRA results to quantify the consequences associated with passive components (such as piping, valve bodies, and heat exchangers).
- Removal of Prescriptive Corrective Actions. The “corrective actions” program element of AMP XI.M33 (with the issuance of GALL-SLR) was revised to include specific recommendations for conducting extent of condition examinations when acceptance criteria are not met. This is consistent with several other GALL-SLR Report AMPs. The NEI document proposes deleting this language; therefore, a technical basis is needed for this change.

## **V. TEAM ASSIGNMENTS**

Brian Allik, Materials Engineer (NRC)  
Jim Gavula, Mechanical Engineer (NRC)  
Michelle Kichline, Senior Reliability and Risk Analyst (NRC)  
Jonathan Evans, Reliability and Risk Analyst (NRC)  
Marieliz Johnson, Project Manager (NRC)  
Brian Harris, Senior Project Manager (NRC)

## **VI. LOGISTICS**

The regulatory audit will be scheduled for September 15, 2022, through October 13, 2022. From September 15, 2022 to September 28, 2022, staff will have access to review the documents provided on the electronic reading room. From September 29, 2022, to October 13, 2022 periodic meetings between the licensee and staff will be scheduled to ask questions, identify any new emerging information needs or close any issues.

The NRC PM will coordinate with the licensee in advance of audit activities to verify specific documents and identify any changes to the audit schedule and requested documents. The audit entrance/exit meetings and weekly audit meeting are to be scheduled as followings:

- Entrance Meeting – September 15, 2022;
- Exit Meeting: October 13, 2022

The NRC staff acknowledges the proprietary nature of the information requested. It will be handled appropriately throughout the audit. While the NRC staff will take notes, the NRC staff will not remove hard copies or electronic files from the audit site.

If necessary, any circumstances related to the conductance of the audit will be communicated to Brian Harris (NRC) at 301-415-2277 or email: [Brian.Harris2@nrc.gov](mailto:Brian.Harris2@nrc.gov) or Marieliz Johnson (NRC) at 301-415-5861 or email: [Marieliz.Johnson@nrc.gov](mailto:Marieliz.Johnson@nrc.gov).

## **VII. SPECIAL REQUESTS**

The NRC staff requests the applicant to make available the SLRA program basis documentation and drawings, and other documents as requested.

## **VIII. DELIVERABLES**

An audit report should be issued to the applicant within 90 days from the end of the Aging Management Regulatory Audit.