

Status of Subsequent License Renewal and Related Activities

Allen Hiser

NRC/Industry Materials Exchange Meeting

May 25, 2022

OUTLINE

- Status of license renewal applications
- Impact of Commission decision on environmental reviews for SLR
- Technical challenges in the SLR reviews
- Consideration of license renewal for 40 years and technical issues for 100 years
- Planned revision 1 of the GALL-SLR and SRP-SLR
- Considerations for risk-informing license renewal

LR is license renewal from 40 to 60 years

SLR is subsequent license renewal from 60 to 80 years

Background References on US Reactor License Renewal

- Nuclear Innovation Conference Webinar video
<https://www.nuclearinnovationconference.eu/webinars>
- License Renewal Background and Status
<https://www.nrc.gov/docs/ML2101/ML21015A336.pdf>
- Overview of Nuclear Power Plant License Renewal and Considerations for 40-Year Renewals
<https://www.nrc.gov/docs/ML2104/ML21042B879.pdf>

Status of Reactor Licenses in the US

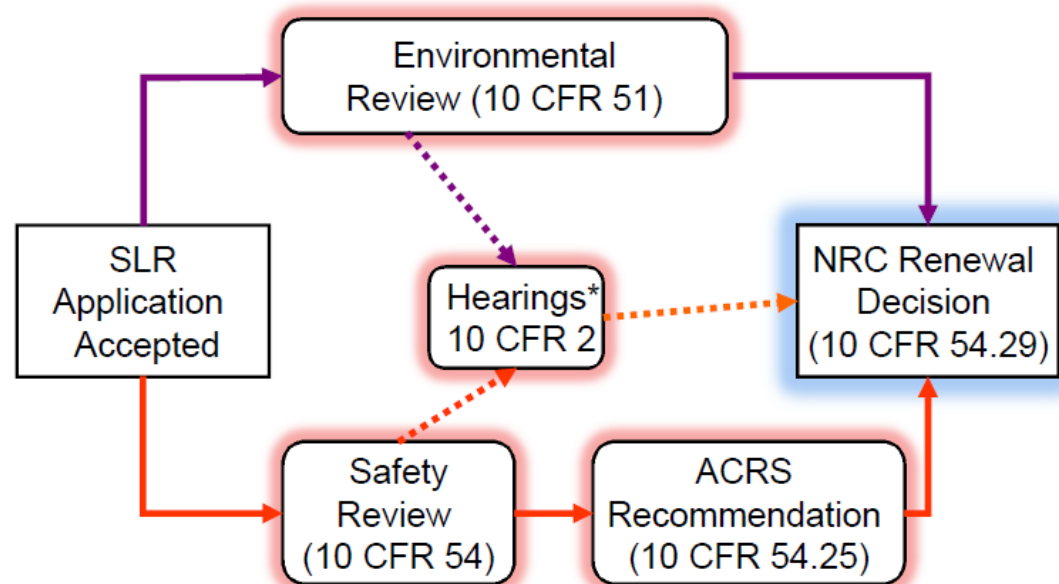
- 92 operating reactor units in the U.S.
- Renewed licenses (to operate for 60 years) issued for 94 units (10 have ceased operations)
 - 8 units with 40-year licenses (Diablo Canyon will shutdown 2024/2025)
 - 78 units with 60-year licenses
 - 6 units with 80-year licenses (Turkey Point, Peach Bottom and Surry)
- 59 units (50 operating) have entered their 41st year of operation; first was in April 2009
 - More than 400 reactor-years of operation beyond the initial 40-year licenses

License Renewal and SLR Applications

- 4 SLR applications under review
 - North Anna Power Station, Units 1 and 2 – received Aug 2020
 - Point Beach Nuclear Plant, Units 1 and 2 – received Nov 2020
 - Oconee Nuclear Station, Units 1, 2, and 3 – received June 2021
 - St. Lucie Nuclear Plant, Units 1 and 2 – received Aug 2021
- 3 SLR applications scheduled
 - Monticello Nuclear Generating Plant, Unit 1 – Jan to Mar 2023
 - Browns Ferry Nuclear Plant, Units 1, 2 and 3 – Dec 2023
 - Virgil C. Summer Nuclear Station, Units 1, 2, and 3 – Oct to Dec 2023
- 3 LR applications scheduled
 - Comanche Peak Nuclear Power Plant, Units 1 and 2 – Oct to Dec 2022
 - Perry Nuclear Power Plant, Unit 1 – July to Sept 2023
 - Clinton Power Station, Unit 1 – Jan to Mar 2024

NRC License Renewal Overview

- NRC regulations (10 CFR Part 54) include:
 - Safety review (aging management, time-limit aging analyses, etc.)
 - Environmental review



* If a Request for Hearing is Granted

Environmental Impact Statement (EIS)

- Regulations for EIS are in [Part 51](#) to Title 10 of the Federal Code of Regulations – relate to National Environmental Policy Act (NEPA) of 1969
- Environmental issues are binned:
 - Category 1: apply to all or a subset of plants
 - Evaluated in [NUREG–1437, Revision 1](#), "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (June 2013) – called “LR GEIS”
 - Category 2: additional plant-specific review is needed
 - Evaluated in environmental report in the application
 - NRC staff prepares a site-specific Supplemental EIS (SEIS), e.g., NUREG-1437 Supplement XX

Commission Orders

On February 24, 2022, the Commission issued three orders ([CLI-22-02](#), CLI-22-03 ([for example](#)), and [CLI-22-04](#)):

- LR GEIS does not apply to SLR; therefore, environmental review is incomplete (regulation states applicable to “initial” renewal)
- Renewed licenses rolled back 20 years
 - Peach Bottom Units 2 and 3
 - Turkey Point Units 3 and 4
- Cannot publish final SEIS documents
 - North Anna Units 1 and 2
 - Point Beach Units 1 and 2
- Cannot publish Draft SEIS documents
 - Oconee Units 1, 2, and 3
 - St. Lucie Units 1 and 2

Response to Commission Direction

- Staff plans
 - Remove the word “initial” from Part 51
 - Update NUREG-1437, Revision 1
 - Thorough analysis of the environmental impacts of subsequent license renewal
- Result would be GEIS applicable to subsequent license renewal
- Effect on issuance of subsequent renewed licenses
 - Use of LR GEIS would result in a delay of ~2 years
 - Applicants can provide a plant-specific assessment of the Category 1 topics that are addressed in the GEIS (NUREG-1437)

SLR Technical Issues

- Reactor pressure vessel – neutron embrittlement
 - Trends for high fluence levels
 - Sufficiency of reactor vessel material surveillance program capsules
- Reactor vessel internals - high fluence effects
 - Irradiation-assisted stress corrosion cracking
 - Loss of fracture toughness
 - Void swelling
- Concrete and containment performance
 - Long-term radiation and high temperature exposure
 - Alkali-silica reaction (ASR)
- Electrical cables
 - Environmental qualification
 - In-service testing of cables
 - Long-term submersion of low and medium voltage cables

Technical Challenges from SLR Application Reviews

- Neutron embrittlement of steel reactor pressure vessel supports
 - Low operational temperatures
 - Evaluated for 60 years but not 80 years
- PWR reactor vessel internal components
 - Approved program is for 60 years
 - Plant-specific analysis needed, using a “gap analysis” to address aging differences from 60 to 80 years
- Buried piping fabricated from gray cast iron material
 - Brittle material with cracking due to cyclic loading

Consideration of 40-Year License Renewal Terms and Plant Operation to 100 Years

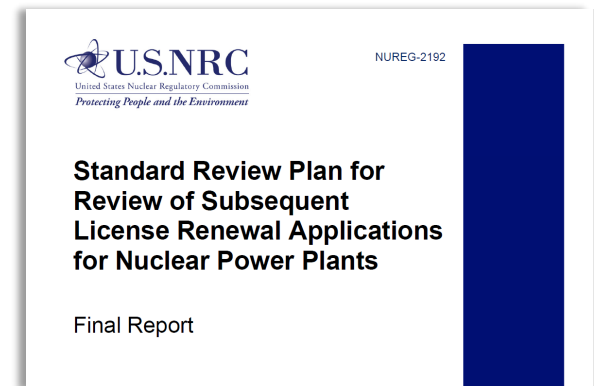
- License Renewal for an Additional 40 years
 - Motivated by a plant with a 40-year license operating near the end of that license
 - Looked at legal/regulatory aspects, environmental review, safety review, and inspection/oversight aspects
 - Public meeting on February 18, 2021 – [ADAMS ML21070A117](#)
 - Industry stated not on their radar right now
 - Public comments generally not supportive
- Technical Issues for 100 years of Operation
 - Public meeting on January 21, 2021 – [ADAMS ML21078A453](#)
 - Industry stated prudent to continue relevant research
 - Public comments generally not supportive
- Closure Memo dated June 22, 2021 ([ADAMS ML21117A007](#))
 - Both of the above activities were discontinued
 - Considered extension of on-going research for 60 years

GALL Report and SRP-LR Versions

- Generic Aging Lessons Learned (GALL) Report ([NUREG-1801](#)) and SRP-LR (Standard Review Plan for License Renewal) ([NUREG-1800](#))
 - Revision 0 – issued July 2001
 - Revision 1 – issued September 2005
 - Revision 2 – issued December 2010
 - Interim changes made using License Renewal - Interim Staff Guidance (LR-ISG) process
 - 10 [LR-ISGs](#) apply to Revision 2
- GALL-SLR ([NUREG-2191](#)) and SRP-SLR ([NUREG-2192](#))
 - Issued July 2017
 - 4 [SLR-ISGs](#) apply to SLR documents

Basis for Development of GALL-SLR

- To reflect expected aging differences for increased operating time from 60 to 80 years
- New plant operating experience since GALL Rev. 2
- Gaps identified in current guidance
- Improvements in efficiency and effectiveness of applications and NRC reviews
- Corrections to GALL Rev. 2 and SRP-LR Rev. 2
- Incorporate Interim Staff Guidance since GALL Rev. 2



Revision of GALL-SLR and SRP-SLR

- 4 SLR-ISGs have been issued
 - [SLR-ISG-2021-01](#): Aging Management Criteria for Reactor Vessel Internal Components of Pressurized Water Reactors
 - [SLR-ISG-2021-02](#): Aging Management Criteria for Mechanical Portions
 - [SLR-ISG-2021-03](#): Aging Management Criteria for Structures Portions
 - [SLR-ISG-2021-04](#): Aging Management Criteria for Electrical Portions

Development of Revision 1 of GALL-SLR

- Public meeting scheduled for June 1
 - Need for the revision
 - Limited scope of the revision
 - Process
 - Timeline
- Products:
 - Revision 1 of GALL-SLR, SRP-SLR and technical basis
 - New document on resolution of public comments
- A multi-year process – finalize end of 2024/2025

Basis for GALL-SLR Revision 1 Changes

- Focus is topics previously identified as possible SLR-ISGs; not a comprehensive review of the documents
- Basis for updates
 - Revised and new guidance based on:
 - New or updated industry guidance, and Codes and standards
 - Plant operating experience
 - To fill gaps or make technical revisions in guidance identified from previous SLR reviews
 - Substantive corrections
 - Incorporate completed SLR-ISGs since initial GALL-SLR

Risk-Informing License Renewal

- Part 54 is largely a deterministic rule
 - Scoping and Screening, aging management review, TLAAAs
 - 54.21(a)(3) - For each structure and component identified . . . , demonstrate that the effects of aging will be adequately managed so that the **intended function(s)** will be maintained consistent with the CLB for the period of extended operation.
- Current use of risk in guidance documents
 - GALL-SLR XI.M41: Piping inspection locations are selected based on risk (i.e., susceptibility to degradation and consequences of failure).

Risk-Informed Aging Management Programs

- Submitted by NEI on February 18, 2021
- Proposed (pilot) AMPs: GALL-SLR XI.M33 (selective leaching) and XI.E3 (non-EQ inaccessible power cables)
- Public meeting scheduled for June 2
- If approved will add to GALL-SLR Revision 1

Risk-Informing LR and SLR

- Public meeting tentative early July
- Follow-up to [March 2022 Regulatory Information Conference \(RIC\) session](#)
- Consider items that can be implemented now consistent with Part 54, or could require rulemaking

Contact Information

Allen L. Hiser, Jr.

301-415-5650

Allen.Hiser@nrc.gov

Related Links

- Reactor License Renewal
<https://www.nrc.gov/reactors/operating/licensing/renewal.html>
- Reactor License Renewal Guidance Documents
<https://www.nrc.gov/reactors/operating/licensing/renewal/guidance.html>
- Guidance for License Renewal and Subsequent License Renewal
<https://www.nrc.gov/reactors/operating/licensing/renewal/slr/guidance.html>
- LR and SLR Interim Staff Guidance (ISG)
<https://www.nrc.gov/reading-rm/doc-collections/isg/license-renewal.html>
- Status of Initial License Renewal Applications
<https://www.nrc.gov/reactors/operating/licensing/renewal/applications.html>
- Status of Subsequent License Renewal Applications
<https://www.nrc.gov/reactors/operating/licensing/renewal/subsequent-license-renewal.html>