



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

June 22, 2021

MEMORANDUM TO: Robert M. Taylor, Deputy Office Director
for New Reactors
Office of Nuclear Reactor Regulation

THRU: Anna H. Bradford, Director */RA/*
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

FROM: Allen L. Hiser, Jr., Senior Technical Advisor */RA/*
for Licensing Renewal Aging Management
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SUBJECT: CLOSURE OF ACTIVITY TO CONSIDER LICENSE RENEWAL
FOR 40 YEARS OF ADDITIONAL NUCLEAR POWER PLANT
OPERATION

The U.S. Nuclear Regulatory Commission (NRC) staff has completed an activity to assess the feasibility of extending the time period for license renewal of nuclear power plants from the current 20 year maximum to a maximum period of 40 years, and to identify options to implement this change. With more than 90 percent of the operating reactors possessing renewed licenses for operation to 60 years, this activity included consideration of the technical issues that would be associated with plant operation to 100 years.

From this activity, as described in the enclosure, the staff has the following recommendations:

- (1) Discontinue the activity to consider regulatory and other changes to enable license renewal for 40 years.
- (2) Consider an evaluation of possible changes to oversight and inspection activities related to license renewal and subsequent license renewal.
- (3) Consider an evaluation to identify on-going research activities (related to concrete, cables, reactor vessel internals and reactor pressure vessels) that could be extended to greater exposure levels (e.g., higher fluence levels) to address the potential for reactor operations up to 100 years.

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- (4) Periodically query the industry to determine their interest and timing to pursue operation to 100 years, so that the staff can identify the need and timeframe to initiate development of guidance documents which would support 100 years of plant operation.
- (5) Consider an evaluation of impacts to plant risk from the combined effects of multiple aged components, and affirmation of the conclusions in NUREG-1412, "Foundation for the Adequacy of the Licensing Bases, A Supplement to the Statement of Considerations for the Rule on Nuclear Power Plant License Renewal (10 CFR Part 54)," should license renewal to 100 years of plant operation be contemplated in the future.

If you have any questions or comments, please contact me at (301) 415-5650 or via e-mail at Allen.Hiser@nrc.gov.

Enclosure:
Closure of 40-Year License
Renewal Activities

SUBJECT: CLOSURE OF ACTIVITY TO CONSIDER LICENSE RENEWAL FOR 40 YEARS
OF ADDITIONAL PLANT OPERATION DATED JUNE 22, 2021

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ADAMS Accession No.: ML21117A007

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CLOSURE OF 40-YEAR LICENSE RENEWAL ACTIVITIES

Background

A public meeting (U.S Nuclear Regulatory Commission (NRC) Agencywide Documents Access and Management System (ADAMS) Accession No. ML20163A627) was held on May 20, 2020, with a licensee that was considering simultaneous applications for a nuclear power plant that would request license renewal (to extend plant operation to 60 years) and subsequent license renewal (to extend plant operation to 80 years). Following this meeting, the NRC staff began an activity to assess the feasibility of extending the time period for license renewal from the current 20 year maximum to a maximum period of 40 years and to identify options for implementing this change.

With more than 90 percent of the operating reactors possessing renewed licenses for operation to 60 years, this activity included consideration of the technical issues that would be associated with plant operation to 100 years.

This activity has reached a point of maturation whereby the staff has developed recommendations for management consideration, as discussed below.

Working Group

A working group was formed to consider the feasibility of license renewal for 40 years (LR40) and to identify options to address topics that would be impacted by implementation of LR40. With the broad range of topics potentially involved, the working group (see table) included staff from potentially-affected Headquarters Offices and Divisions, along with staff from the Regional offices. Most group activities were performed in a subgroup format, with separate subgroups addressing topics related to legal/regulatory issues, the environmental review, the safety review, and inspection/oversight aspects. The overall group worked collegially to identify the topics that are potentially affected by LR40, and, following two public meetings, reached a consensus for recommendations.

When this work reached a relatively mature state, a briefing of the Office of Nuclear Reactor Regulation (NRR) management was held. The NRR Office Director suggested that public meetings be held in order to gauge public and industry perspectives on LR40.

Public Meetings

Initially, one public meeting was planned to discuss both 40-year license renewal and technical issues related to nuclear power plant operation to 100 years. The latter topic was a natural consequence of 90 percent of the plants possessing 60-year operating licenses and the potential for those plants to pursue 40-year license renewal if that option were made available. Ultimately the meetings were separated, with the technical issues meeting held in mid-January 2021, and the meeting on 40-year license renewal held in mid-February 2021.

Enclosure

Public Meeting on Technical Issues for Plant Operation to 100 Years

This meeting was held on January 21, 2021. The public meeting notice described the meeting purpose as:

The NRC is seeking public dialogue related to license renewal for nuclear power reactors, specifically the need (and timing) for the NRC to consider the potential technical issues and guidance document development related to license renewal that would authorize operation for up to 100 years, including:

- Should the NRC begin to consider the potential technical issues and the development of guidance documents to support license renewal to authorize operation for up to 100 years, and if so, when?
- What are the technical issues that could be potential challenges for license renewal to 100 years?
- What approaches should be used to optimize the development of data to address potential technical challenge areas, if any, for operation up to 100 years?

The meeting included an NRC presentation on license renewal overview and history, followed by presentations in a session on timing of guidance document development, and presentations in separate sessions on technical issues for mechanical components, civil structures and concrete, and electrical and instrumentation and controls components. The presenters included representatives from the NRC, Nuclear Energy Institute (NEI), the Electric Power Research Institute, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Beyond Nuclear, Texas A&M, and the University of Colorado.

NEI noted they were not aware of any utility that is actively contemplating a license renewal to enable 100 years of operation or intends to in the near future. However, NEI expressed prudence in continuing relevant research on aging to extend our current level of knowledge, given the lead time needed to implement and complete research activities.

The public comments aligned with the meeting purpose were generally not supportive of operation up to 100 years, including concerns over reactor pressure vessel surveillance specimens, the age of foundations for plants with extended construction times, and parts of the plant that cannot be inspected. Other public comments addressed nuclear waste including plans for interim storage, cask storage of high burn-up fuel and inability to inspect storage canisters for cracking, impact of effluents and reporting, license renewal of fuel fabrication facilities, and lack of consideration of external factors (e.g., plant siting, climate change).

The meeting summary is provided under ADAMS Accession No. ML21047A253. A package of all information associated with the meeting is provided at ADAMS Accession No. ML21078A453. This package includes links to the meeting summary, several pre-meeting documents describing the meeting, the meeting transcript, and the presentations.

Public Meeting on License Renewal for 40 Years of Additional Plant Operation

This meeting was held on February 18, 2021. The public meeting notice described the meeting purpose as obtaining information regarding the following questions:

- For plant owners/operators, is there an interest in license renewal for 40 years, and how likely would you utilize this approach compared to the current process (i.e., separate 20-year license renewals)?
- What should the NRC take into account when considering whether to change the limit of license renewal to 40 years from the current 20 years?
 - If a decision is made to pursue regulatory and process changes to enable license renewal for 40 years, what collateral changes should the NRC make to the license renewal program to ensure that all plants will continue to “provide reasonable assurance of adequate protection of the public health and safety” during the period of extended operation?
 - Extending the “Generic Environmental Impact Statement for License Renewal of Nuclear Plants” (LR GEIS) to 40 years from the current 20 years
 - Application contents and review process
 - Safety guidance documents for license renewal (e.g., Generic Aging Lessons Learned (GALL) report and Standard Review Plan (SRP))
 - Inspection and oversight program

The meeting included an NRC presentation on the basis for the current 20-year limit to license renewal and an extended period for public comments. A representative from the NEI stated that there are no plants considering the combination of a subsequent license renewal (SLR) application with a license to 100 years. He further stated that the NEI neither supports nor opposes this activity.

The public comments were generally not supportive, citing concerns with the need to benchmark aging management programs (AMPs) for the proposed 40-year license extension period, extension of the 2013 Generic Environmental Impact Statement for License Renewal to cover a 40-year license renewal period, inadequacies in reactor pressure vessel material surveillance and embrittlement predictions, limitations that would occur on public engagement, and inadequate local outreach for environmental meetings.

The meeting summary is provided under ADAMS Accession No. [ML21047A253](#) [ML21070A149](#)^a. A package of all information associated with the meeting is provided at ADAMS Accession No. [ML21078A453](#)-[ML21070A117](#)^a. This package includes links to the meeting summary, several pre-meeting documents describing the meeting, the meeting transcript, and the presentations.

^a *Corrected August 17, 2021.*

Discussion

LR40 Activities

Following these various activities, the working group met to identify recommendations for management consideration. On the topic of further actions to address LR40, a strong majority of the group supported a position to discontinue further work on developing options and strategies for implementation related to regulatory and other changes that would enable license renewal for 40 years. Although implementation of LR40 could have benefits to both applicants and the NRC, this recommendation was based on the lack of interest from the industry and the strong, adverse public response.

Inspection/Oversight Topics

During the LR40 working group discussions, several topics related to inspection and oversight were identified for consideration. Following the public meetings and after further discussions, the working group identified several recommendations for consideration:

- Subsequent License Renewal Inspection Program

The NRC's license renewal inspection program implements two Inspection Procedures (IP) specific to license renewal, IP 71002, "License Renewal Inspection," and IP 71003, "Post-Approval Site Inspection for License Renewal." IP 71002 is implemented contemporaneous with and supports the staff's review of a license renewal application (LRA) for operation from 40 to 60 years. Similarly, the first three phases of IP 71003 are implemented to support initial license renewal only. Phase IV is described in IP 71003 as:

"likely to occur 5-10 years into the [period of extended operation] PEO to verify the licensee is managing aging effects in accordance with the aging management programs described in the updated final safety analysis report. Phase IV is intended to review the implementation of the aging management program elements during the PEO to ensure the [systems, structures, and components] SSCs have maintained their ability to perform their intended function."

As described in IP 71003, the Phase IV inspection is not required to be performed and is intended to be a one-time inspection per site, generally implemented in the 45 to 50 year time frame. No Phase IV inspection would be implemented with SLR based on the current inspection procedure.

The group recommends an evaluation of the need for and benefits of development of a Subsequent License Renewal Inspection Program, including inspection of AMP effectiveness, to assess licensee implementation of their AMPs. In addition, this evaluation would consider the need for additional guidance on implementation of Phase IV inspections to enhance inter-Region consistency.

- Baseline Inspection Program to incorporate inspections focusing on aging management
The NRC's current baseline inspection program in the Reactor Oversight Program (ROP) focuses on activities and systems that are "risk significant." This focus contrasts

to the review of LRAs in accordance with 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," which does not distinguish between the in-scope systems, structures and components (SSCs) that are risk significant and those that are not.

To reconcile the "risk significant" focus of the ROP inspection program and the deterministic scope of 10 CFR Part 54, the group recommends updating the baseline engineering inspection program to include periodic aging management inspections. The staff's recommendation would be satisfied through implementation of changes similar to those proposed in SECY-18-0113, "Recommendations for Modifying the Reactor Oversight Process Engineering Inspections," (ADAMS Accession No. ML18144A567). The proposed update before the Commission includes the development and implementation of a comprehensive engineering team inspection that incorporates aspects of several current baseline inspections and separate, focused engineering inspections (FEIs) concentrated on operating experience and aging management. In Option 2 of SECY-18-0113, the staff would develop and implement an FEI on aging management if the proposed updates described in SECY-18-0113 are approved. If approved, an FEI on aging management could be implemented on a frequency of every 4-5 years.

The staff continues to believe that the proposed updates in SECY-18-0113 would provide effective oversight of aging management implementation.

- Oversight/enforcement of the failure to take corrective actions for in-scope nonsafety-related SSCs

Findings from license renewal related inspections, such as IP 71003 Phase IV, are evaluated from a safety significance perspective that is characteristic of the NRC's Reactor Oversight Process. Since a significant proportion of the SSCs that are in-scope for license renewal are nonsafety-related, issues of concern related to corrective actions for these nonsafety-related SSCs are not enforceable. The working group recommends consideration of options to balance or elevate issues of concern related to nonsafety-related SSCs that are in-scope for license renewal.

- Inspection emphasis on "future risk" vs. current risk

Related to the current oversight focus on the risk-significance of inspection findings (i.e., "the current risk"), inspection issues of concern related to aging management deficiencies generally have limited current risk; however, if left uncorrected, these concerns could result in elevated plant risk. The working group recommends consideration of enhancing the use of risk insights in license renewal inspections through potentially adding guidance to Appendix E of IMC 0612 and inspector training.

Technical Topics for 100 Years of Plant Operation

If the NRC's license renewal regulations are modified to permit license renewal for 40 years, then the large number of plants with 60-year licenses would be able to seek licenses to operate to 100 years. Since the current license renewal guidance documents address plant operation to 80 years (i.e., GALL-SLR and SRP-SLR), the adequacy of these documents to support

100 years of SSC operation, or the need for separate documents for 100 years of operation, has not been assessed. In addition, with six reactor units possessing subsequently renewed licenses for operation to 80 years, these units (and others with renewed licenses which could pursue licenses to operate to 80 years) could ultimately seek licenses to operate for 100 years, potentially beginning in 2029.

The public meeting on January 21, 2021, was designed to address technical issues for 100 years, and presentations in each of the technical review areas (e.g., mechanical, electrical, and civil structures) identified potential topics of interest and ideas for development of guidance documents for 100 years. Although NEI identified no utility interest in plant operation to 100 years, NEI expressed prudence in continuing relevant research on aging to extend our current level of knowledge, given the lead time needed to implement and complete research activities.

The working group was divided on whether to take a position on initiating development of guidance documents for 100 years. However, a consensus was reached to propose investigating research opportunities to extend the exposure levels for the major aging management issues identified in the staff requirements memorandum (SRM) to SECY-14-0016 (ADAMS Accession No. ML14241A578) dated August 14, 2014. The issues identified in the SRM are reactor pressure vessel neutron embrittlement at high fluence, irradiation-assisted stress corrosion cracking of reactor internals and primary system components, concrete and containment degradation, and electrical cable qualification and condition assessment.

With on-going NRC research in these areas (cracking of reactor internals, concrete and containment degradation, and electrical cable qualification and condition assessment), the group recommends consideration of efficiency and effectiveness of extending this on-going research to increase the exposure levels to address expected conditions for 100 years of operation.

Closure of this recommendation will be achieved in a memorandum from the Directors of the NRR Division of New and Renewed Licenses (DNRL) and Division of Engineering and External Hazards (DEX) to the Director of the Division of Engineering (DE) in the Office of Nuclear Regulatory Research (RES). The contents of this memorandum to RES will be informed by an evaluation of return on investment from extending on-going research activities as compared to delaying the research until a later time when utility interest in pursuing plant operation to 100 years has been clarified. The outcomes of this memorandum could be changes to user need requests or other communication tools.

In addition to the on-going research cited above, the continued efforts to explore and pursue opportunities to harvest materials and components from decommissioned plants, for example as described in ADAMS Accession No. ML19134A232, also can be used to provide insights and data on materials aging at high exposure levels. The staff assesses harvesting opportunities as they arise to determine whether the data on materials aging will be useful/beneficial for supporting long term operation.

Other Topics Discussed

- Timing for Development of GALL and SRP for 100 Years

With the position that development of guidance documents for 100 years would not be initiated now, the group considered the topic of when development of these documents should be initiated. The group noted that the earliest date at which an application for operation to 100 years could be submitted (without an exemption from 10 CFR 54.17(c)) is 2029 (e.g., the earliest expiration date for a 60-year renewed license). For reference, the NRC staff began planning development of the SLR guidance documents in 2009 (coincident with the first expiration for an initial license of a plant with a renewed license), started public outreach in 2012, and issued the final documents at the end of 2017.

Beyond the technical topics identified in the SRM to SECY-14-0016, the group surmised that, for many of the SSCs that are in-scope of license renewal, most of the new information that would be used to update the guidance documents for 100 years would be from OE and lessons learned from reviews of subsequent license renewal applications. Therefore, it may be possible to utilize the GALL-SLR and SRP-SLR, as revised using the SLR-ISG process, for review of the initial LRAs for 100 years of operation with only minor changes/updates to the guidance.

To identify the timeframe to initiate development of guidance documents for 100 years of plant operation, the group recommends periodic queries of the industry to determine their interest and possible timing of license renewal applications for operation to 100 years.

- Consideration of License Renewal to 100 Years

Should license renewal to extend plant operation to 100 years be contemplated in the future, the group identified recommendations in two areas.

One area is to consider an evaluation of the impact on plant risk of the combined effects of aging on multiple components within the scope of license renewal. This evaluation would assess the impact on plant risk from the functional failure of one or more components when considering the effects of aging on the ability of associated components to perform their intended functions.

A second area is to consider an evaluation to affirm the conclusions in NUREG-1412, "Foundation for the Adequacy of the Licensing Bases, A Supplement to the Statement of Considerations for the Rule on Nuclear Power Plant License Renewal (10 CFR Part 54)," that were used to support the adequacy of the limited-scope license renewal review focused on managing the effects of aging. As an example, the adequacy of generic safety issue resolutions that were based on license renewal to 60 years would be revisited to ensure the conclusions are still valid for license renewal to 100 years.

Consideration of these two areas is recommended to begin about 5 years before the projected submittal of a license renewal application for operation to 100 years.

Recommendations

Based on its assessment of the information obtained during the course of this activity, the working team recommends the following:

- (1) Discontinue the activity to consider regulatory and other changes to enable license renewal for 40 years.
- (2) Consider an evaluation of possible changes to oversight and inspection activities related to license renewal and subsequent license renewal.
- (3) Consider an evaluation to identify on-going research activities (related to concrete, cables, reactor vessel internals and reactor pressure vessels) that could be extended to greater exposure levels (e.g., higher fluence levels) to address the potential for reactor operations up to 100 years.
- (4) Periodically query the industry to determine their interest and timing to pursue operation to 100 years, so that the staff can identify the need, and timeframe, to initiate development of guidance documents which would support 100 years of plant operation.
- (5) Consider an evaluation of impacts to plant risk from the combined effects of multiple aged components, and affirmation of the conclusions in NUREG-1412, "Foundation for the Adequacy of the Licensing Bases, A Supplement to the Statement of Considerations for the Rule on Nuclear Power Plant License Renewal (10 CFR Part 54)," should license renewal to 100 years of plant operation be contemplated in the future.

Next Steps

With the issuance of this memorandum, the remaining task is to identify recommendations on extension of on-going research activities to achieve greater exposure levels (e.g., higher fluence levels) to address expected conditions for 100 years of operation.

LR40 Working Group

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ERLRB: Environmental Review License Renewal Branch

ERNRB: Environmental Review New Reactors Branch

RRPB: Reactors Rulemaking and Project Management Branch

NRR/DNRL: Office of Nuclear Reactor Regulation, Division of New and Renewed Licenses

NCSG: Corrosion and Steam Generator Branch

NLRP: License Renewal Projects Branch

NPHP: Piping and Head Penetrations Branch

NVIB: Vessels and Internals Branch

NRR/DEX: Division of Engineering and External Hazards

ESEB: Structural, Civil, Geotech Engineering Branch

ELTB: Long Term Operations & Modernization Branch

NRR/DRA: Division of Risk Assessment

ARCB: Radiation Protection and Consequences Branch

NRR/DANU: Division of Advanced Reactors and Non-Power Production and Utilization Facilities

UART: Advanced Reactor Technical Branch

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GCHA: Operating Reactors Division

GCRPS: Reactor and Materials Rulemaking Division

RES/DE: Office of Nuclear Regulatory Research, Division of Engineering

CIB: Component Integrity Branch

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