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MEMORANDUM TO: Andrea L. Kock, Deputy Director
Office of Nuclear Reactor Regulation

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Office of Nuclear Reactor Regulation

FROM: Bo M. Pham, Director */RA/*
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Office of Nuclear Reactor Regulation

SUBJECT: OFFICE OF NUCLEAR REACTOR REGULATION PRELIMINARY
RECOMMENDATIONS ON IMPROVING THE POWER UPRATE
APPLICATION AND REVIEW PROCESS

The purpose of this memorandum is to transmit to the Office of Nuclear Reactor Regulation (NRR) the preliminary recommendations that the Power Uprate (PUR) Project Team identified for improving the quality of the PUR application process and for achieving efficiencies in the review process. These internal findings and recommendations form the initial foundation of the staff's effort to enhance the PUR review process, which will be further supplemented with feedback from external stakeholders.

Enclosure:
NRR Preliminary Recommendations on Improving
the PUR Application and Review Process

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OFFICE OF NUCLEAR REACTOR REGULATION

PRELIMINARY RECOMMENDATIONS

ON IMPROVING THE POWER UPRATE APPLICATION AND REVIEW PROCESS

BACKGROUND

The U.S. Nuclear Regulatory Commission (NRC) regulates the maximum power level at which a commercial nuclear power plant may operate. This power level is used, with other data, in many of the licensing analyses that demonstrate the safety of the plant and is included in the license and technical specifications for the plant. The process of increasing the maximum power level at which a commercial nuclear power plant may operate is a power uprate (PUR) and follows the license amendment request (LAR) process in accordance with 10 CFR 50.90.

Improvements in instrument accuracy, computational tools and engineering models, in addition to plant hardware modifications, have allowed licensees to request power uprates while maintaining safety margins. The three categories of power uprates are:

- measurement uncertainty recapture (MUR) power uprate, an increase of up to 2 percent licensed reactor power,
- stretch power uprate (SPU), an increase of up to 7 percent licensed reactor power, and
- extended power uprate (EPU), an increase up to 20 percent of licensed reactor power.

The current staff guidance for power uprate reviews can be found in Review Standard (RS)-001, "Review Standard for Extended Power Uprates" (ML033640024) and NRR Office Instruction LIC-112, Revision 2, "Power Uprate Process," Revision 2 (ML19254A627).

Although the NRC has a well-established process for reviewing PUR applications (referenced above), as demonstrated by over 170 PUR applications that have been approved, the NRC is proactively identifying further efficiencies and improvements for the PUR licensing application reviews.

On August 16, 2022, Congress passed the Inflation Reduction Act (IRA). Key provisions of the IRA include production tax credits and investment tax credits that nuclear utilities can leverage to offset costs related to PURs. Consequently, utilities are re-examining the benefits of PURs to their existing nuclear power plants. After the IRA was passed, over 50 percent of nuclear power plant licensees surveyed¹, expressed interest in pursuing PURs. Given the forecast of multiple PUR applications and consistent with the 2024 ADVANCE Act, the staff is in the process of identifying opportunities to improve and optimize our reviews.

STAFF EFFORTS TO DATE

The NRC's Office of Nuclear Reactor Regulation (NRR), Division of Operating Reactor Licensing (DORL), created a PUR Project Team. The PUR Project Team consists of PUR

¹ From the Nuclear Energy Institute, "The Future of Nuclear Power - 2023 Baseline Survey" (ML23242A166).

subject matter experts (SMEs), DORL project managers, the PUR branch chief in DORL, and a DORL senior executive service champion that coordinates with other senior executives in technical divisions to align in the priority of the project and facilitate identification of efficiencies in the review of power uprates. The PUR Project Team keeps abreast of when PURs will be submitted to the NRC for review, leads development and issuance of deliverables, facilitates the formation and prioritization of a “core team,” that includes representation from all technical divisions as appropriate, and provides guidance and support for the plant project managers. To date, the PUR Project Team has developed the following measures:

- PUR Core Team Charter (ML24156A109): This charter provides guidelines to establish and maintain the same cadre of reviewers that will be responsible for reviewing PUR applications. The core team will ideally consist of experienced or senior staff members, maintained through strategic knowledge transfer opportunities. The core team concept will facilitate more efficient reviews, incorporating lessons learned from one PUR review to the next.
- PUR Project Plan (ML24110A141): The project plan focuses the NRC’s preparations to conduct efficient and effective reviews of PUR applications. It provides a schedule for deliverables and includes targeted public interactions in addition to those listed in the PUR Communication Plan. The Project Plan will be revised following the issuance of the staff’s recommendations to streamline/improve the PUR process as the staff moves toward implementation of recommendations.
- PUR Communication Plan (Package ML24025A160 (not publicly available, sensitive information)): This internal plan will be used in conjunction with the PUR Project Plan. This plan facilitates communication strategies to enable the staff to provide timely, consistent, and understandable information to our internal and external stakeholders. In addition, this plan identifies opportunities for meaningful public outreach to enhance the public’s understanding of our safety and regulatory activities regarding PURs.
- A regulatory issue summary (RIS) has been developed which will, when approved by the Office of Management and Budget, request information from licensees on the type and timing of PUR related applications. The estimated issuance of the RIS is the first quarter of calendar year 2025.
- A risk-informed assessment/streamlining working group that includes representation from all technical divisions, has been formed and is meeting regularly to evaluate internal processes to increase efficiency and timeliness associated with PUR reviews, while still assuring safety. Additional information on this effort is detailed below.
- External Stakeholder Engagement: The staff engaged with external stakeholders by holding multiple public meetings to focus staff’s efforts and understand potential process improvements. See additional details on external stakeholder engagement in “Recommendation 1” below.

Risk-Informed Assessment/Streamlining Working Group Team Formation Initial Scoping

To prepare for the expectation of an influx of PUR licensing applications, NRR management has directed staff to perform a risk-informed assessment of the PUR review process and issue a report documenting preliminary recommendations by the end of this fiscal year (FY).

Given that direction, the PUR Project Team focused on EPU's since those historically have been the most complex and required the most resources. The first step in that effort was data-mining previous reviews to identify which technical areas had the largest equities for EPU reviews based on percentage of resources spent during reviews. The following are the NRR review branches with the largest equities in EPU reviews and their associated resource contribution to recent EPU reviews:

- Mechanical Engineering and Inservice Testing Branch: 20-25 percent
- Nuclear Systems Performance Branch: 15 percent
- Licensing Project Branch: 11 percent
- Containment and Plant Systems Branch: 10 percent
- Electrical Engineering Branch, Radiation Protection and Consequence Branch, and Nuclear Methods and Fuel Analysis Branch, each contributed between five to nine percent.

Experienced technical and project management staff from these areas constitute the working group members. Additional technical areas (e.g. the environmental center of expertise, the probabilistic risk assessment (PRA) branch, and technical specification branch) were requested to join working group meetings to facilitate focused discussions as needed. The working group has been meeting since February 2024.

Risk-Informed Assessment/Streamlining Working Group Considerations

The working group reviewed and considered the following items:

- As RS-001 has not been updated since 2003, each working group member is evaluating whether there are any new developments in their technical areas to be considered that could change the scope of the PUR review, or whether any portions of RS-001 could be scoped as low risk, reducing or eliminating review effort. In addition, the working group is reviewing LIC-112 and LIC-109, Revision 3, "Acceptance Review Procedures for Licensing Basis Changes" for potential revisions to streamline the process for completing power uprate reviews.
- The Division of Risk Assessment (DRA) considered the current state of risk knowledge with plants having PRA models to determine if risk insights could be leveraged in PUR reviews.
- Technical reviewers identified what parts of the review could be graded based on safety significance in their areas of expertise. See additional information in "Recommendation 2" where the staff is currently refining the binning criteria to provide the staff additional guidelines to focus their review on the most safety significant areas.

- Project Managers assessed the review process to identify areas and elements within the process that could be streamlined (e.g., safety evaluation (SE) templates, concurrences, and Office of the Advisory Committee on Reactor Safeguards (ACRS) engagement).

Based on these activities, the working group members developed the following preliminary recommendations:

Recommendation 1: Continue Engagement with Stakeholders

The working group noted that continued engagement with the industry and the public are necessary to focus our efforts and understand the areas that could potentially be difficult for the staff to review. The staff has engaged stakeholders on the following topics through an initial public meeting in June 2024. Additional engagement on these topics with stakeholders will be beneficial. These include:

- a. How efficiencies that can be gained through submission of potential linked amendments, including identification of amendments that should be submitted before a PUR is submitted.
- b. Areas where there is significant and small analytical margin as a result of PURs.
- c. How industry will address the most safety significant systems/issues impacted from the PUR and the actions licensees plan to take to address them. Focus on how risk insights can be leveraged to grade/streamline the PUR reviews.
- d. Areas that have been previously approved in other licensing actions. Note: The NRC has identified areas of Generic Aging Lessons Learned (GALL) overlap that could be leveraged. Staff is evaluating other areas that can be leveraged, such as Topical Reports.
- e. New and novel areas that may develop based on combination of PURs with other updates such as increased enrichment and/or high burn up fuel. Early identification of these issues will ensure proactive approaches.

On September 5, 2024, a public meeting was held to discuss current NRC guidance related to combined or linked license amendments. The meeting was attended by more than 85 NRC staff and public participants. The discussion focused on examples of bundled and linked amendments, so that staff can understand and identify what kind of bundled/linked amendments to expect and the best approach to review these types of applications. The NRC staff and NEI came to a common understanding of licensees' plans of bundling and/or linking planned license amendments requests, such as an EPU combined with application of Maximum Extended Load Line Limit Plus (MELLLA+) and a power uprate combined with a fuel transition. Additionally, it was agreed that these plans should be discussed in pre-application public meetings and discussions would be documented in public meeting summaries. NEI also discussed a proposal to allow LARs to reference unapproved topical reports (at the draft safety evaluation stage), the use of license conditions, and addressing challenges associated with environmental qualifications for higher burnup/increased enrichment for power uprates. Staff is reconsidering the amount margin that is included in EQ-related radiological calculations (e.g., application of more realistic core inventories) as well as reviewing current assumptions that are commonly

used in EQ analyses. Staff is open to public discussions in early 2025 to provide insights into the staff's work and obtain feedback from stakeholders. The staff will consider these recommendations during preparation for future submittals and will continue to engage NEI and/or licensees as needed.

In addition, a workshop will be scheduled in the October 2024 timeframe to discuss topics such as leveraging the recently NRC-approved topical report on data validation and reconciliation for MURs and other topical reports.

The working group is strategically considering the most beneficial time to update guidance documents. The working group does not recommend updating the guidance documents ahead of the first set of scheduled PUR applications because the changes have not been tested, but also understands the need to provide the staff guidance on process changes and enhancements. The working group is considering options such as developing a desk guide or interim guidance, which leverages information from the public workshops, before the first SPU or EPU application and refining this guidance with learnings gained during the first couple of PUR reviews before incorporating it into more durable guidance.

Recommendation 2: Adopt a Graded Approach that Considers Risk-Insights and is Commensurate with the Requested PUR Levels, Available Margin, and Complexity of the Uprate Request

The working group looked for ways to focus the uprate reviews on the most safety significant portions of the application. This graded approach will enable the staff to evaluate the extent to which the PUR changes impact important to safety structures, systems, and components (SSCs) functions and requirements associated with the applicable sections of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Edition," (SRP). To do this, the following three categories will be used to grade the expected level of effort commensurate with its safety and risk significance and the degree to which the PUR affects them:

- **Bin 1:** Review areas expected to require little or no review:

This category includes review areas (systems) that are not subject to impact by PUR because PUR will not likely effect system design or operation. For these review areas, the PUR will have no significant impact on operating conditions or variables.

Examples: hazards (flood protection, equipment and floor drainage systems, light and heavy load handling systems, internally generated missiles) and compressed air systems.

Staff Review: If there are no impacts on the review area, the SE only needs to confirm that the PUR will have no impact on the review area, and the associated regulatory requirements will continue to be met. The SE for these sections can be potentially reduced to a single section listing the review areas covered by this category in a table, with a short writeup indicating the staff's finding that the systems included in the table were not impacted by the uprate and compliance with the regulations were not affected.

- **Bin 2:** Review areas that are affected by a power uprate, which need to be reviewed against regulations, but are unlikely to have a significant impact on nuclear safety:

This category includes review areas (systems) that may be impacted by PUR due to potential changes in system design or operating conditions but would have little to no impact on plant safety. Systems that would be reviewed in this category include the power conversion systems and non-safety-related ventilation systems covered by the SRP. For these review areas, the PUR is not likely to result in changes that would have a significant impact on nuclear safety since uprate conditions are not expected to exceed the design parameters (pressure, temperature, flow, etc.) for the SSCs.

Examples: main steam system; condensate and feedwater system; turbine generator condenser; and various non-safety-related plant heating, ventilation, air conditioning systems; materials and chemical engineering; and mechanical and civil engineering areas.

Staff Review: In general, these systems do not perform safety-related functions (other than containment isolation), and their failure would not adversely affect the performance of safety-related SSCs. If the changes are bounded by the current analysis, the review only needs to verify that fact and no further review would be required; however, if the review is not bounded by current operation or analysis, or if there are major system modification-like upgrades (e.g., condensate and feedwater pumps), the staff will review the system and/or analysis results for compliance to the applicable regulations.

- **Bin 3:** Review areas directly impacted by operation at uprated power and expected to require more detailed review:

This category includes review areas (systems) that are impacted by the PUR because the PUR will result in changes to the systems' design and analyses or operation. For example, reactor water cooling systems covered by the SRP for which the power uprate will result in changes to heat removal requirements. Therefore, these systems will require a more thorough review. The staff will grade its review of these areas according to safety/risk significance.

Examples: steam dryers, service water system, reactor component cooling water system, ultimate heat sink, spent fuel pool, and analyses such as reactor and containment

Staff Review: Conducted in accordance with the guidance in RS-001.

During the working group review, the PRA staff determined that approximately 30 percent of the PUR-related SRP sections are risk amenable (i.e., those that impact core damage frequency or large early release frequency). The working group determined that the binning could be further refined by consideration of identified risk insights provided by the PRA staff, principles of defense-in-depth and safety margins, and other relevant factors such as operational experience. This information can be used to inform the staff's review hours and schedules, using the information in LIC-112 as a starting point, to the various sections of the application based on safety significance.

Recommendation 3: Continued Process Improvements in Targeted Areas

The working group also identified process improvements that could enhance review efficiency in several areas. These include:

- Streamlining the environmental assessments (EA). EAs will not be needed for MURs as they are categorically excluded under 10 CFR 51.22(c)(9). However, EAs may be

needed for SPUs if there is a direct impact from an increase in thermal heat loads on aquatic resources and an increase in radioactive waste. EAs will continue to be needed for EPU. Staff is considering potential reduction in resources as a result of the Fiscal Responsibility Act of 2023, which would leverage previous environmental reviews and the licensee's environmental report; performing a "bounding" EA similar to the generic environmental impact statement for license renewal in an effort to streamline site -specific EAs; and ensuring that roles and responsibilities of the NRR and NMSS staff are clearly understood and documented.

- Streamlining project management aspects of the review, such as:
 - Simplify the existing RS-001 SE template. Develop pressurized-water reactor and boiling-water reactor SE boilerplates, starting with the SE templates in RS-001 that can be used and adjusted (add or delete sections), depending on the LAR.
 - Provide project management guidance to leverage modern project manager tools, such as the SharePoint/Teams Channel and collaborative work documents.
 - Leverage the audit process to facilitate fluid exchange of information for reviewers' understanding of the PUR. Following the regulatory audit, conduct weekly standing public meetings (similar to the reviews associated with the Vogtle Electric Generating Plant, Units 3 and 4 52.103g finding), where technical issues can be addressed quickly without waiting 10 days to notice a public meeting. Fully utilize regulatory audits to revolve issues.
 - Identify all previously approved topical reports that were not previously reviewed and approved by the Office of the General Counsel (OGC) and send them to OGC for no legal objection review in advance of the receipt of PUR LARs.
 - Explore the possibility of changing the signature authority for EPU from NRR Office Director to DORL Division Director.
 - Early alignment with ACRS on expectations for its review for EPU reviews (e.g., only on new or novel areas).
 - Leverage preapplication meetings to facilitate mutual understanding of the PUR application. The staff recommends conducting at least two thoroughly comprehensive public EPU preapplication meetings with the licensee. At a minimum, one meeting should occur at the outset of the licensee's intention to submit a PUR LAR to establish what actions need to be completed (e.g., topical reports; exemptions; license amendments) before the PUR LAR is docketed. A second public meeting should occur at no less than 2 months before the PUR LAR is docketed for review to ensure that the action items from the first meeting are complete. In addition, pre-submittal activities could also include readiness assessments using the guidelines of LIC-116, "Preapplication Readiness Assessment."
- Consider updating the PUR inspection procedure (IP 71004 - ML21244A225) to conduct a PUR inspection after acceptance of a PUR application, but prior to approval of a PUR, with the intent of informing and potentially streamlining the PUR licensing review.

STAFF EFFORTS MOVING FORWARD

Following the issuance of this memorandum, the working group plans to continue its efforts to:

- engage with external stakeholders as detailed in Recommendation 1. This includes additional workshops to identify technical challenges and solutions for combining power uprate reviews with other changes such as increased enrichment or high burn up, among others.
- refine the graded approach definitions included in Recommendation 2. The staff is currently performing preliminary binning of each system for an EPU using the provided definitions, risk insights provided by the PRA staff, principles of defense-in-depth, safety margins, and other relevant factors such as operational experience. Once this is complete, the staff plans to provide guidance for reviewers to aid in adjusting the binning once more information is received during pre-submittal or in the application. The staff plans to include the graded approach as a potential future workshop with external stakeholders.
- evaluate and implement targeted improvements as detailed in Recommendation 3. In parallel with Recommendations 1 and 2, the staff plans to further refine the infrastructure and process improvements to support power uprate reviews.

Once the working group completes its external stakeholder engagement, the staff will issue another memorandum to describe the final recommendations and its schedule for completion of those recommendations.

SUBJECT: OFFICE OF NUCLEAR REACTOR REGULATION PRELIMINARY
 RECOMMENDATIONS ON IMPROVING THE POWER UPRATE APPLICATION
 AND REVIEW PROCESS DATED SEPTEMBER 30, 2024

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