

# framatomē

## Licensing Guidance for Lead Test Assemblies

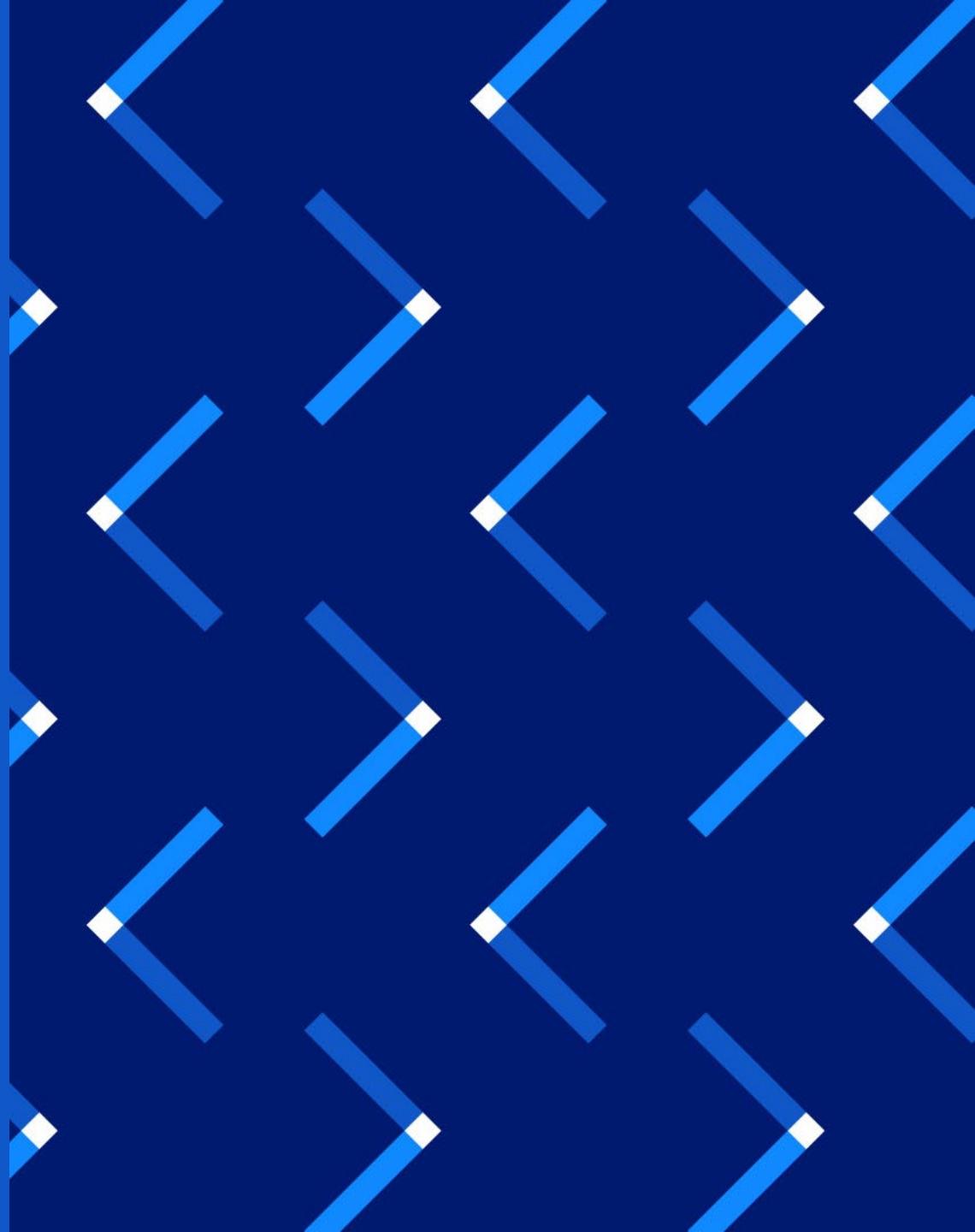
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Pre-Submittal Meeting

April 11, 2024

# Content

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# Introduction

- The purpose of ANP-10356NP, *Licensing Guidance for Lead Test Assemblies*, is to provide guidance on the interpretation and implementation of the Technical Specification (TS) Lead Test Assembly (LTA) provision within the plant's existing licensing bases.
- TS 4.2.1, *Fuel Assemblies*, contains the following language:  
*A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.*
- This topical report provides guidance to assist licensees in making the decision as to whether a future LTA irradiation program satisfies these requirements.

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Licensing Guidance for Lead Test Assemblies

ANP-10356NP  
Revision 0

Topical Report

March 2024

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0414-12-F04 (Rev. 004, 04/27/2020)

# Licensing Framework

- LTAs are inherently part of the plant's licensing bases and an allowance for their **restricted** use already exists.
  - For plants with the TS LTA provision which have shown compliance with the restrictions on quantity and placement, the LTAs may be loaded and irradiation without prior NRC approval. In this instance, the LTAs are compliant with the plant's licensing bases as defined in the TS.
  - For plants with the TS LTA provision which do **not** show compliance with the restrictions on quantity and placement, the LTAs may **not** be loaded and irradiation without prior NRC approval. In this instance, the LTAs are outside of compliance with the plant's licensing bases as defined in the TS. An LAR in accordance with § 50.90 would be necessary.
- For plants without the TS LTA provision, loading and irradiating LTAs under the provisions of § 50.59 may be allowed but is not the subject of this topical report.

# Need for Guidance

- LTAs provide vital information to characterize irradiated properties and performance that is necessary for the development and licensing of new technologies.
- Due to the lack of regulatory guidance and industry standards, the licensing approach for many past LTA programs has diverged significantly.
  - Differing interpretations and opinions amongst NRC and industry staff regarding the TS LTA provision and constraints within 10 CFR 50.59, *Tests, changes, and experiments*.
  - Given this regulatory uncertainty, many licensees have opted to submit a License Amendment Request (LAR) in accordance with 10 CFR 50.90, *Application for amendment of license, construction permit, or early site permit*.
  - These past LARs have reinforced certain long-held positions amongst both NRC and industry staff that the TS LTA provision provides little opportunity and flexibility and § 50.59 constraints direct licensees to submit LARs.

# Building Upon Precedent

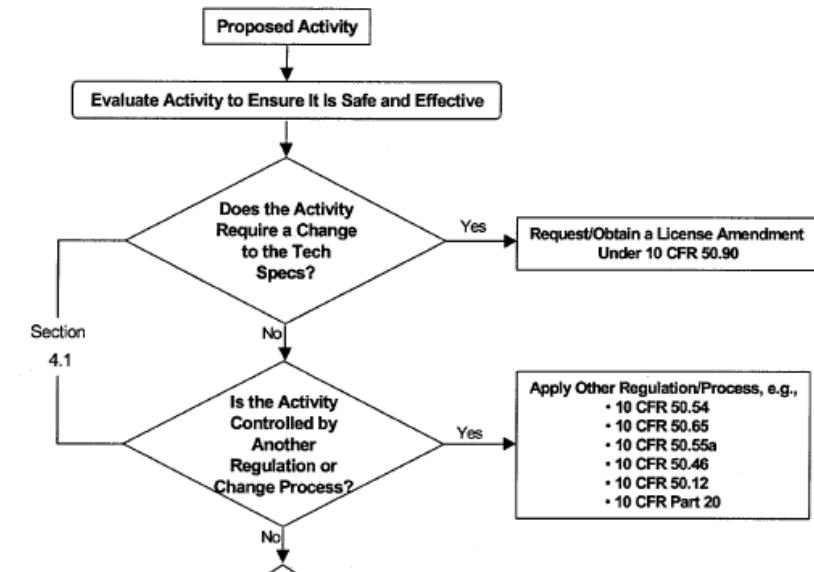
- Building upon NRC staff interpretations, positions, and informal guidance, this topical report provides licensees the regulatory guidance needed to interpret and implement the TS LTA provision, and a clear licensing framework for different types of LTA programs.
  - **GESTAR II, NEDE-24011-P-A-29, Amendment 51, November 2020**
  - NRC letter to NEI, Clarification of Regulatory Path for LTAs, June 2019
  - Z4B Fuel Channel Irradiation Program, July 2017
  - Enhanced LUC Program for NSF Channels, September 2012
  - Limited Scope High Burnup LTA Program, September 2003

# Conflicts with § 50.59 Evaluation

- In many of these precedents, the NRC staff has established a link between § 50.59 evaluation criteria and compliance to the TS LTA provision.
- Based upon a literal read of § 50.59, potential conflicts exist with the following evaluation criteria:
  - § 50.59(c)(2)(iii) minimal increase in consequences,
  - § 50.59(c)(2)(vii) design basis limit,
  - § 50.59(c)(2)(viii) departure of a method of evaluation.
- Recent NRC staff actions suggest that compliance with the TS LTA provision superseded these potential conflicts.
  - Effectively establishing a position that compliance to the TS LTA provision equated to a negative § 50.59 evaluation (i.e., no license amendment request).
- This position has led to confusion and could still be interpreted as conflicting with the regulation.
- Framatome is proposing a refined LTA licensing bases which avoids conflicts and provides a straightforward licensing path.

# Refined Licensing Bases

- LTAs are inherently part of the plant's licensing bases and an allowance for their restricted use already exists.
  - LTAs which comply with the TS LTA provision do not meet the definition of a change to the facility or its procedures, nor a test or experiment.
  - LTAs which comply with the TS LTA provision should screen out of the licensee's 50.59 process.
- NEI 96-07 provides a logic diagram for performing § 50.59 screenings and evaluations which asks the question: *Is the activity controlled by another regulation or change process?*
  - A negative response to this question kicks the activity out of the § 50.59 process.



# Refined Licensing Bases (cont.)

- LTAs are effectively controlled by the plant's technical specifications which are mandated by 10 CFR 50.36, *Technical specifications*.
  - Following NEI's logic diagram, LTAs which comply with the TS LTA provision should screen out of the licensee's § 50.59 process.
- This refined licensing bases removes regulatory uncertainty by eliminated conflicts with § 50.59 evaluation criteria.
  - **Maintains LTA restrictions and safety requirements relative to earlier precedents.**
  - **No relaxation in reasonable assurance of adequate protection.**
- Since the guidance restricts LTAs from dictating or forming the bases of COLR operating limits, this topical report does not need to be added to the COLR list of approved methods (e.g., TS 5.6.5).

# Classifications of LTAs

- LTAs may be comprised of many different mechanical, thermal-hydraulic, or nuclear design features, new or different combinations of materials, and/or application of existing, approved designs or materials beyond their experience base (i.e., higher burnup or fluence).
- In this guidance, LTAs are segregated into three distinct groups, **each with their own limitations and restrictions with respect to the TS LTA provision:**
  1. Lead Research Assemblies (LRA)
  2. Lead Use Assemblies (LUA)
  3. High Burnup Lead Use Assemblies (HBLUA)

# Common Guidance

- Consistent with approved GETSAR II lead assembly guidance
  - Restriction on quantity and placement (i.e., thermal margin) work in concert to provide reasonable assurance of adequate protection of public health and safety.
  - Combinations of limited numbers and thermal margin setbacks should take into account the relative impact of the LTA's new feature on applicable regulatory requirements and design criteria, the available margin to those criteria, and any uncertainty incurred by the lack of in-reactor experience or characterization of irradiated properties.
  - LTA evaluation must confirm that potentially limiting UFSAR safety analysis, including docketed radiological consequences, remain applicable.
  - The LTA's presence in the reactor core and/or anticipated performance must not necessitate changes to plant Technical Specification or Core Operating Limits Report (COLR) limits.
  - The nuclear aspects of the LTA shall be designed such that reload batch fuel assemblies are limiting during steady state operation (with respect to radial peaking factors, MCPR).
  - LTAs shall be designed and analyzed to provide reasonable assurance that regulatory requirements associated with fuel performance under AOOs and DBAs are satisfied with sufficient margin to account for limited in-reactor experience or gaps in the degree of characterization of irradiated properties and performance.
    - This may require larger thermal margin setbacks and/or reduced quantities of LTAs.
- Departure from approved GETSAR II lead assembly guidance
  - LTA programs which satisfy TS LTA provision screen-out of § 50.59 process
    - No guidance on interpreting § 50.59 evaluation criteria

# LRA Guidance

- Consistent with approved GETSAR II lead assembly guidance

- An acceptable limiting number of LRAs, taken in concert with any necessary thermal margin setback, depends on the nature of the new design feature, amount of in-reactor experience, and characterization of irradiated properties and performance.
- The number of lead test rods comprised of new materials (i.e., non-UO<sub>2</sub> fuel, non-zirconium cladding) with minimal or no prior in-reactor experience and characterization of irradiated properties and performance needs to be restricted to insignificant quantities (e.g., less than 0.1% of core) such that unanticipated, unacceptable performance would not interfere with the ability of safety-related systems, structures, and components (SSCs) to perform their intended functions.
- The LRA evaluation requires some engineering judgment because of the potentially incomplete availability of representative data before irradiation of the LRAs, and evaluation may necessitate using modified or different codes and methods in the form of: (1) modifications to approved codes and methods, (2) use of approved codes and methods outside the bounds for which they were explicitly approved, or (3) use of a code or method, based on well-established engineering practices, that the NRC has not previously approved.

- Departure\* from approved GETSAR II lead assembly guidance

- An acceptable limiting number for lead research channels, taken in concert with any necessary thermal margin setback, depends on the nature of the new design feature and/or material, amount of in-reactor experience, and characterization of irradiated properties and performance.
- Lead research channels do not require restrictions on core placement.

\* GESTAR did not separately address channels. Guidance consistent with NSF and Z4B lead channel programs.

# LUA Guidance

- Consistent with approved GETSAR II lead assembly guidance
  - The number of LUAs shall be limited to 16 for BWRs with greater than or equal to 560 assemblies, and 8 for BWRs with fewer than 560 assemblies.
  - The LUA evaluation is performed using approved analytical methods and design criteria.
- Departure\* from approved GETSAR II lead assembly guidance
  - The number of LUAs shall be limited to 8 for PWRs.
  - The number of lead use channels shall be limited to 32 for BWRs with greater than or equal to 560 assemblies, and 16 for BWRs with fewer than 560 assemblies.
  - Lead use channels do not require restrictions on core placement or thermal margin setbacks.
  - LUAs and LUCs shall not be operated beyond the approved fuel burnup (or fluence) limit defined in their license basis (e.g., fuel design change process, fuel rod thermal-mechanical model).

\* GESTAR did not separately address channels. Guidance consistent with NSF and Z4B lead channel programs. Numerical values below 8% core inventory approved in these earlier programs.

# HBLUA Guidance

- Consistent with approved GETSAR II lead assembly guidance
  - Nominal  $^{235}\text{U}$  depletion eliminates the need for explicit thermal margin setbacks (i.e., HBU fuel will operate at lower power than low burnup fuel rods).
  - The HBLUA evaluation requires some engineering judgment because of the potentially incomplete availability of representative data beyond the licensed burnup limit, and evaluation may necessitate using modified or different codes and methods in the form of: (1) modifications to approved codes and methods, (2) use of approved codes and methods outside the bounds for which they were explicitly approved, or (3) use of a code or method, based on well-established engineering practices, that the NRC has not previously approved.
- Departure\* from approved GETSAR II lead assembly guidance
  - An acceptable limiting number of HBLUAs depends on the amount of in-reactor experience and characterization of irradiated properties and performance at the target burnup (beyond licensed burnup limit).
  - An acceptable limiting number of high burnup lead use channels depends on the amount of in-reactor experience and characterization of irradiated properties and performance at the target fluence/burnup (beyond licensed burnup limit).
  - High burnup lead use channels do not require restrictions on core placement or thermal margin setbacks.

\* GESTAR did not separately address channels. Guidance consistent with NSF and Z4B lead channel programs. Numerical values below 8% core inventory approved in these earlier programs. GESTAR specified a numerical limit for HBLUAs along with a maximum burnup. GESTAR HBLUAs would include HBU channels.

# Additional Guidance

- Similar to GESTAR II, guidance is provided on the following topics:
  - Coincident LTA programs
  - Allowable analytical approaches for radiological consequence assessment
  - 10 CFR 50.46 exemption requirements

# Review Plan

- Unlike many topical reports where the product of the review is an analytical model or fuel design, the product of this review is the guidance contained within the topical report.
- It is expected that licensees will use the topical report, either directly or built into their internal procedures, to make licensing decisions concerning future LTA programs.
- To avoid confusion and misuse, Framatome proposes to use change pages to incorporate any necessary updates in response to staff concerns and RAIs.
- Goal is to eliminate deviations in approved guidance nested in RAI responses or in the final safety evaluation via limitations and conditions.

# Review Schedule

Submittal of ANP-10356NP

Requested Approval

- June 2024
- June 2025

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you

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