



# Lead Test Assembly (LTA) License Amendment Request (LAR) Pre-Submittal Meeting

Ryan Joyce – SNC  
May 11<sup>th</sup>, 2022



## Introductions and Purpose

- Introductions
  
- Purpose of the Meeting

Discuss the proposed Westinghouse lead test assemblies (LTAs) at Vogtle Unit 2 and receive NRC feedback prior to LAR submittal



## Agenda



- **Vogtle LTA Program Objective**
- **LAR Outline**
  - Vogtle LAR Format
  - Proposed License Condition
- **Topics of Interest**
  - LTA Evaluation Method and Approach
  - Cladding Exemption – 10 CFR 50.46 and 10 CFR 50 Appendix K
  - Enrichment Exemption – 10 CFR 50.68(b)
  - Source Term/Environmental Considerations
  - Impact on Probabilistic Risk Assessment (PRA), Severe Accidents (SAMG) Timing
- **Schedule**
- **Question**

## Vogtle LTA Program Objective



- Initial goals of program (within scope of proposed license amendment request (LAR)):
  - Irradiate higher enriched fuel in a commercial reactor to generate data in support of future licensing applications
  - Obtain additional data for accident tolerant fuel (ATF) materials
- Future goal of program (outside scope of proposed LAR):
  - Support licensing applications for higher burnup fuels
- Four Westinghouse ATF LTAs with higher enrichment capable of higher burnup
  - Four rods each with enrichment up to 6 w/o U-235
  - **AXIOM**<sup>®</sup> high performance fuel rod cladding
  - **EnCore**<sup>®</sup> chromium coated cladding
  - **ADOPT**<sup>™</sup> doped fuel material for non-IFBA (Integral Fuel Burnable Absorbers) rods
  - Standard (undoped) fuel material for IFBA rods
- Additional information to be provided during the closed session

ADOPT, AXIOM, and EnCore are trademarks or registered trademarks of Westinghouse Electric Company LLC, its affiliates and/or its subsidiaries in the United States of America and may be registered in other countries throughout the world. All rights reserved. Unauthorized use is strictly prohibited.



## Key Analytical Impacts of the LTAs

- LTAs will lead the core during portions of steady-state operation and during some transient conditions
  - Leading the core = highest linear heat generation rate
- The LTAs and co-resident fuel will be shown to continue to meet all Technical Specifications (TS) 2.1 Safety Limits, 3.1 Reactivity Control, and TS 3.2 Power Distribution Limit requirements
- LTAs will remain within core operating limits
- The analytical methods used to determine the core operating limits will be those previously reviewed and approved by the NRC (per TS 5.6.5)
- A separate LAR will be required to go above the licensed fuel rod burnup limit

# LAR Outline

## Vogtle LAR Format



- Enclosure 1: Evaluation of the Proposed Change [Prop]
  - Attachment 1: Proposed Facility Operating License Markups
- Enclosure 2: Evaluation of the Proposed Change [non-Prop]
- Enclosure 3: 10 CFR 50.46 and 10 CFR 50 Appendix K Exemption
- Enclosure 4: 10 CFR 50.68 Exemption
- Enclosure 5: Affidavit for Enclosure 1

## Proposed License Condition



~~D. The facility requires exemptions from certain requirements of 10 CFR Part 50 and 10 CFR Part 70. These include (a) an exemption from the requirements of 10 CFR 70.24 for two criticality monitors around the fuel storage area, and (b) an exemption from the requirements of Paragraph III.D.2(b)(ii) of Appendix J of 10 CFR 50, the testing of containment air locks at times when containment integrity is not required.~~ The facility requires an exemption from the requirements of Paragraph III.D.2(b)(ii) of Appendix J of 10 CFR 50, the testing of containment air locks at times when containment integrity is not required. The special circumstances regarding exemption are identified in Section 6.2.6 of SSER 5.

~~An exemption was previously granted pursuant to 10 CFR 70.24. The exemption was granted with NRC materials license No. SNM-1967, issued August 21, 1986, and relieved GPC from the requirement of having a criticality alarm system. GPC and Southern Nuclear are hereby exempted from the criticality alarm system provision of 10 CFR 70.24 so far as this section applies to the storage of fuel assemblies held under this license.~~



## Proposed License Condition (continued)



New License Condition (Appendix D):

Lead test assemblies (LTAs) 7ST1, 7ST2, 7ST3 and 7ST4 contain fuel rods that include advanced cladding features, and doped or standard fuel material. These LTAs are permitted to be **placed in limiting core regions for up to two cycles** of operation without completion of representative testing. Each of the four LTAs may contain up to **four fuel rods with a maximum nominal U-235 enrichment of 6.0 weight percent**; the maximum nominal U-235 enrichment of the remaining 260 fuel rods must be  $\leq 5.0$  weight percent. These LTAs are permitted to have unrestricted storage in the new fuel storage racks and restricted storage in the Unit 2 spent fuel pool (SFP). For the SFP storage requirements, these **LTAs shall be treated with [additional storage controls]**.

- Additional information to be provided during the closed session

The background consists of several overlapping geometric shapes in various shades of gray. A large, light gray triangle is on the left, pointing downwards. A darker gray triangle is on the right, pointing upwards. A medium gray triangle is in the center, pointing downwards. A vertical gray bar is on the right side. The text 'Topics of Interest' is overlaid on the left side of the image.

# Topics of Interest

## Overview of LTA Evaluation Method and Approach



- ATF materials modeled by making conservative adjustments to codes and methods where necessary
  - Modeling consistent with descriptions in NRC-approved topical reports (where available) or based on the most recent level of characterization (from Westinghouse development or NRC interactions on ongoing topical report reviews) for materials not yet approved
- Conservative assumptions made for mechanical and thermal-hydraulic design
  - Fuel Assembly Hydraulic and Mechanical testing during design development to confirm
  - Thermal-Hydraulic departure from nucleate boiling (DNB) evaluation during reload design process to confirm LTAs are bounded by current Analysis of Record
- Some NRC-approved methods outside Vogtle current licensing basis used solely to assess performance of the LTAs
  - PAD5 fuel performance models and design criteria
  - PARAGON2 transport code
- Additional information to be provided during the closed session

## Overview of LTA Evaluation Method and Approach (cont'd)



- Justification for current LOCA evaluation model (BASH) provided relative to the NRC restrictions on its use; assessments performed to show LTAs and co-resident fuel meet 50.46 acceptance criteria or more restrictive embrittlement criterion proposed for **AXIOM** cladding substrate
- Chromium coating added to the outer diameter of standard zirconium-alloy cladding
  - No performance benefits credited for coated cladding
  - The following will be demonstrated through confirmatory testing:
    - No adverse mechanical design impacts
    - No adverse impact on normal operating corrosion rates
    - No adverse impact on design-basis accident criteria
- Additional information to be provided during the closed session

## Exemption – 10 CFR 50.46 and 10 CFR 50 Appendix K



- An exemption to 10 CFR 50.46 and 10 CFR 50 Appendix K will be requested for use of **AXIOM** cladding
- A more restrictive embrittlement criterion will be used in conjunction with the 17% maximum local oxidation criterion
  - **AXIOM** cladding topical presents the data in support of this application
- Additional information to be provided during the closed session

## Exemption – 10 CFR 50.68 – Criticality Analysis



- Licensing basis to change from 70.24 to 50.68
- Exemption is needed to 50.68(b)(7) to allow these LTAs to have greater than 5 weight percent U-235 rods
- Technical Justification:
  - Intent of rule (to preclude inadvertent criticality) being maintained
  - Remaining 50.68(b) criticality requirements are unaffected and continue to be implemented
    - Configuration controls applied (Traveller B)
    - New Fuel Storage Vault
    - Spent Fuel Pool
- Additional information to be provided during the closed session

## Assessment of Radiological Consequences



- Southern Nuclear is in the process of submitting a LAR to implement Alternate Source Term (AST) into the radiological consequences licensing basis
  - Planned submittal date Summer 2022
- Impact of increased enrichment assessed as follows:
  - Current Licensing Basis
    - Present comparisons of LTA versus AOR core nuclide inventories
    - Comparisons show current AORs remain conservative
      - Only analyses that postulate core damage are considered for LTA impact (reactor coolant system (RCS) inventories not impacted)
  - Future Licensing Basis (AST)
    - Comparison performed similar to the current licensing basis
    - Demonstrates core inventories utilized for AST submittal are also conservative
    - Note: AST not going to be discussed in LAR
- Environmental Considerations
  - Plan to submit LAR under categorical exclusion clause
  - Enriched LTAs have inconsequential impact on AOR

## Impact on Probabilistic Risk Assessment (PRA), Severe Accidents (SAMG) Timing



- To assess the impact on PRA, Severe Accident Timings, and the Surveillance Frequency Control Program, the following were considered:
  - Impact on decay heat (negligible)
  - Impact on hottest core node temperature (negligible)
  - Impact on Core Exit T/C Temperature (negligible)
  - Impact to ATWS (none)
- Based on the above, there are no impacts for PRA, severe accident timings, or the Surveillance Frequency Control Program



## Schedule



Activity	Schedule
Second NRC Presubmittal Meeting	May 11, 2022
Submittal of LTA LAR & Exemptions	June 30, 2022
NRC Approval of LTA LAR & Exemption	<b>No later than July 15, 2023</b>
Delivery of LTAs to Site	<b>No later than August 13, 2023</b>
Startup Unit 2 Cycle 24	October 2023
Startup Unit 2 Cycle 25	Spring 2025

# Questions/Discussion

## Full Proposed License Condition



New License Condition (Appendix D):

Lead test assemblies (LTAs) 7ST1, 7ST2, 7ST3 and 7ST4 contain fuel rods that include advanced cladding features, and doped or standard fuel material. These LTAs are permitted to be **placed in limiting core regions for up to two cycles** of operation without completion of representative testing. Each of the four LTAs may contain up to **four fuel rods with a maximum nominal U-235 enrichment of 6.0 weight percent**; the maximum nominal U-235 enrichment of the remaining 260 fuel rods must be  $\leq 5.0$  weight percent. These LTAs are permitted to have unrestricted storage in the new fuel storage racks and restricted storage in the Unit 2 spent fuel pool (SFP). For the SFP storage requirements, these **LTAs shall be treated with the following storage controls**:

- Prohibited from Unit 1 SFP
- Unrestricted storage allowed in the Unit 2 2-out-of-4 checkerboard storage configuration as shown in Figure 4.3.1-1
- Storage allowed in the Unit 2 3-out-of-4 checkerboard storage configuration as shown in Figure 4.3.1-1 when the LTAs reach 26500 MWd/MTU of burnup
- Storage allowed in the Unit 2 all-cell storage configuration (“A” assemblies as shown on Figures 4.3.1-3 and 4.3.1-5) when the LTAs reach 46000 MWd/MTU of burnup
- Storage in the peripheral cells of the 3x3 checkerboard storage configuration (“L” assemblies as shown on Figures 4.3.1-5 and 4.3.1-6) is prohibited
- Storage of fresh LTAs in the central cell of the 3x3 checkerboard storage configuration (“high enrichment” fuel assemblies as shown in Figure 4.3.1-2 and “H” assemblies as shown on Figures 4.3.1-5 and 4.3.1-6) is acceptable for LTAs with >60 IFBA rods per assembly