



# Vogtle Unit 2 Pre-Submittal for Westinghouse Increased Enrichment Accident Tolerant Fuel Lead Test Assemblies

January 27, 2022





## **Introductions and Purpose**

- Introductions
- Purpose of the Meeting

Early engagement meeting with NRC to discuss plans for implementation of Westinghouse lead test assemblies (LTAs) at Vogtle Unit 2.



## Agenda

- Description of LTA Program
- Overview of Primary Analytical Impacts
- Review of Spent Fuel Pool and New Fuel Storage Criticality Requirements
- Overview of License Amendment Request
- LTA Transport
- Timeline and Future Plans
- Questions and Adjourn



## Vogtle Units 1 and 2 Overview

- Westinghouse 4-loop pressurized water reactor (PWR)
- 193 Fuel Assemblies
  - 17x17 array
  - 264 rods/assembly
  - 0.360 rod outside diameter
  - 12' active fuel height
- 3625.6 megawatts thermal



## Description of LTA Program

- 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 (one or more rods may be uncoated)
  - **ADOPT**<sup>™</sup> doped fuel material for non-IFBA (Integral Fuel Burnable Absorbers) rods
  - Standard (undoped) fuel material for IFBA rods

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# **Overview of Primary Analytical Impacts**



## Overview of Licensed Methods

- ATF materials will be modeled by making conservative adjustments to codes and methods where necessary
  - Modeling will be consistent with descriptions in NRC-approved topical reports (where available) or based on the most recent level of characterization for materials not yet approved (from Westinghouse development or NRC interactions on ongoing topical report reviews)
- 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
- Justification for current LOCA evaluation model (BASH) will be provided relative to the NRC restrictions on its use; assessments will be performed to show LTAs and co-resident fuel meet 50.46 acceptance criteria
- NRC-approved VIPRE-W thermo/hydraulic methods used for LTAs



## Key Analytical Impacts of the LTAs

- LTAs will lead the core (have highest power) during portions of steady-state operation and during some transient conditions
- The LTAs and co-resident fuel will be shown to continue to meet all Technical Specifications (TS) 3.1 Reactivity Control and TS 3.2 Power Distribution Limit requirements
- **A separate LAR will be required to achieve high fuel rod burnup limits (e.g. 68 or 75 GWD/MTU).**





# Review of Spent Fuel Pool and New Fuel Storage Criticality Requirements

## Background on Current Spent Fuel Pool and New Fuel Storage Licensing Basis



- 10 CFR 70.24 with NRC-approved exemptions for Spent Fuel Pool (SFP)
  - No enrichment limit
  - 10 CFR 50.68 not part of licensing basis; no exemption required
- TS maximum U-235 enrichment of 5.0 w/o U-235 in the SFP and 5.05 w/o U-235 in the New Fuel Storage Racks (NFSRs)
- Multiple SFP Storage Configurations
- SFP Analysis of Record:
  - Does contain Soluble Boron Credit
  - Does contain Burnup Credit
  - Contains fresh IFBA Credit for a storage configuration



## LTAs – Criticality Focus

- The following LTA characteristics are beyond current analysis of record (AoR) scope, and will be addressed in LAR:
  - Increased enrichment
  - **ADOPT**<sup>™</sup> pellets
  - Chromium coated **AXIOM**<sup>®</sup> cladding
- Intent to provide acceptable storage requirements using the AoR storage configurations (or a subset thereof) via Comparative Reactivity Analysis
  - Use modern codes – Scale 6.2+ with associated cross section libraries
  - Separate storage evaluations for fresh fuel analysis (SFP & NFSRs) and burned fuel analysis



# **Overview of License Amendment Request**



## Applicability of Regulatory Framework

- ATF fuel materials are being NRC reviewed within current framework
  - **ADOPT**™ fuel under NRC review (WCAP-18482-P)
  - **AXIOM**® cladding under NRC review (WCAP-18546-P)
  - **EnCore**® chromium coated cladding to be submitted
- NRC ATF Project Plan, Version 1.2 (ML21243A298), Section 6, “While higher burnup and increased enrichment may affect how licensees demonstrate compliance with regulatory requirements, the principal design and performance requirements of the GDC remain applicable”



## Proposed License Amendment Request

- Revise TS 4.2.1 – “Fuel Assemblies”
  - Add description of the LTAs, key features, materials
- Revise TS 4.3.1 – “Criticality”
  - LTA specific storage requirements
- Potential Changes
  - Revise TS 3.7.18 – “Fuel Assembly Storage in the Fuel Storage Pool”
    - Possible addition of penalty factor on the burnup requirement specific to the LTAs
- The LTAs will comply with all other TS requirements



## Exemptions Pursuant to 10 CFR 50.12

- Since the LTAs will lead the core, a request for exemption from 10 CFR 50.46 and Appendix K will be submitted
  - Request exemption from the fuel cladding material and to apply Baker-Just equation to **AXIOM**<sup>®</sup> cladding
  - All other aspects of the regulations will continue to be observed and compliance to applicable GDC will be demonstrated
- For SFP storage of the LTAs, the Vogtle licensing basis continues to be 10 CFR 70.24 with NRC-approved exemptions
  - Inadvertent or accidental criticality will be precluded through compliance with the proposed TS, the geometric spacing of fuel assemblies in the new fuel storage facility and spent fuel storage pool, and administrative controls imposed on fuel handling procedure
  - Exemptions to 10 CFR 70.24 continue to remain valid
  - No exemption from 10 CFR 50.68(b)(7) will be needed



## 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 3Q22
- LTA radiological consequence assessment will be performed based on AST models
  - Impact to radiological consequences expected to be negligible





LTA Transport



## LTA Transport

- LTA will be transported in the Traveller-B Package
  - US NRC license USA/9380/B(U)F-96
  - Amendment submitted to NRC August 2021 with planned NRC approval by March 2022
- Traveller-B amendment LTA contents
  - $\leq 6\%$  U-235 enriched fuel assembly
  - **ADOPT**<sup>™</sup> fuel, Cr-coated cladding
  - Additional content and safety analysis report (SAR) revisions
- No special arrangement, exemptions, or one-time transport approval required, as all regulatory requirements are met
  - 71.55(g) is not applicable
- Westinghouse is the NRC applicant and the consignor (i.e., shipper of record) of material for DOT shipper requirements



# Timeline and Future Plans

## Projected Timeline



Activity	Projected Completion
Engineering and Analysis	June 2022
Additional NRC Touchpoints	As needed
Submittal of LTA LAR & Exemption	Early 3Q2022
Submittal of AST LAR	3Q2022
NRC Approval of LTA LAR & Exemption	August 2023
Delivery of LTAs to Site	September 2023
Startup Unit 2 Cycle 24	November 2023
Reload and Start of Unit 2 Cycle 25	Spring 2025



**Questions?**