



Turkey Point Units 3 and 4

License Amendment Requests for Transition to 24-Month Fuel Cycles

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Westinghouse Project Support



Meeting Agenda

- **Objectives**
- **Licensing Actions**
- **Methodology & Approach**
 - **ADOPT™**
 - **AXIOM®**
 - **FSLOCA™**
 - Non-LOCA
 - Rod Ejection and RG 1.236
 - Spent Fuel Pool Criticality
- **Project Status**
- **Proposed Schedule**
- **Questions**

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Objectives

- **Provide overview of FPL's plan to transition Turkey Point Units 3 & 4 to 24-Month Fuel Cycles**
 - Scope and content
 - Schedule
- **Obtain NRC feedback**
 - LAR Content
 - Approval schedule

Completed Licensing Actions

- **WCAP-16996-P-A Revision 1 “Realistic LOCA Evaluation Methodology Applied to the Full Spectrum of Break Sizes”**
 - Amendment 296, 289 - May 2022 (ML22028A064)
- **Requirements of Generic Letter 91-04**
 - Surveillance Frequency Control Program per TSTF-425
 - Amendments 263, 258 - July 2015 (ML15166A320)
 - Containment Leak Rate Test Frequency Extension per NEI 94-01, Rev 3A
 - Amendments 295, 288 - May 2021 (ML21119A355)
 - Revised Frequencies for Steam Generator Tube Inspections per TSTF-577
 - Submitted with Improved Standard Technical Specifications transition LAR (ML22089A195)

Proposed Licensing Actions

- **Spent Fuel Pool Criticality License Amendment Request**
 - Incorporates fuel management changes
 - Updated to fully comply with latest guidance
- **24-Month Fuel Cycle License Amendment Request**
 - Fuel design change technical justifications
 - NSSS and BOP analyses updates
 - Instrument drift (per GL 91-04)
 - Tech Spec, Bases, TRM and COLR markups
- **Exemption Request for AXIOM Fuel Cladding**

Methodology & Approach

ADOPT Fuel Introduction

- **Reason for change:**
 - Improved fuel cycle economics due to 2% density increase
- **WCAP-18482-P approved ADOPT fuel in November 2022**
- **Licensed for use in all PWR reactor designs**
 - Compatible with NRC-approved zirconium based cladding materials, including **AXIOM**
 - Existing NRC-approved analytical methods and models are appropriate for ADOPT fuel designs
 - Will comply with the limitation and condition by utilizing 3D rod ejection and RG 1.236

Methodology & Approach

AXIOM Fuel Cladding Introduction

- **Reason for change:**
 - Improved corrosion resistance and reduced hydrogen pickup
 - Reduced cladding creep and growth
- **WCAP-18546-P was submitted in March 2021**
 - Applicable to all current PWR fuel designs
 - New models and methods developed as necessary for some of the properties different from existing cladding
 - Existing NRC-approved safety analysis methods are compatible with **AXIOM**
 - Compatible with conventional and **ADOPT** fuel pellets
- **The ACRS Material, Metallurgy, and Reactor Fuel Subcommittee reviewed and recommended approval of the AXIOM topical report on October 4, 2022**

AXIOM Cladding requires an exemption from 10 CFR 50.46

Methodology & Approach

AXIOM Cladding Topical Report Addressed 10 CFR 50.46c Research Findings

Current acceptance criteria

- Peak cladding temperature - 10 CFR 50.46 (b)(1)
- Maximum cladding oxidation - 10 CFR 50.46 (b)(2)
- Maximum hydrogen generation - 10 CFR 50.46 (b)(3)
- Coolable Geometry - 10 CFR 50.46 (b)(4)
- Long-term cooling - 10 CFR 50.46 (b)(5)

AXIOM cladding fuel performance criteria

- Peak cladding temperature - 10 CFR 50.46c (g)(1)(i)
- Cladding embrittlement - 10 CFR 50.46c (g)(1)(ii)
- Breakaway oxidation - 10 CFR 50.46c (g)(1)(iii)
- Maximum hydrogen generation - 10 CFR 50.46c (g)(1)(iv)
- Long-term cooling - 10 CFR 50.46c (g)(1)(v)
- Implicitly demonstrated by meeting fuel performance criteria and accounting for changes in core geometry during postulated accident

Content of AXIOM cladding topical report established applicable fuel performance criteria

Methodology & Approach

FSLOCA Re-analysis

- **Reasons for re-analysis:**
 - AXIOM topical report's Limitations and Conditions
 - Cycle length
 - Blanket design
 - Burnable poison
 - Power shape libraries and burnup dependent peaking factor limits
 - **ADOPT** fuel pellets
- **WCAP-16996-P-A Revision 1**
 - Approved for Turkey Point, May 2022
 - Amendment 296, 289 (ML22028A064)

The re-analysis will be subject to reporting
pursuant to 10 CFR 50.46 (a)(3)(ii)

Methodology & Approach

Non-LOCA Re-analysis

- **Technical evaluations for UFSAR Chapter 14 Non-LOCA analyses**
 - No changes to analysis models or methods, except Rod Ejection
 - Changes addressed via updated analysis inputs
 - Increased cycle length
 - Fuel design changes
 - Steam generator tube plugging limit increase
- **The majority of Non-LOCA events are being reanalyzed**

Methodology & Approach

Rod Ejection - Approved Codes and Methods

- **Uses 3D core kinetics**
- **NRC approved methodology**
 - WCAP-15806-P-A, “Westinghouse Control Rod Ejection Accident Analysis Methodology Using Multi-Dimensional Kinetics”
- **Similar approach as for AP1000® PWR Core Reference Report**
 - WCAP-17524-P-A, “AP1000 Core Reference Report”
 - This used the interim limits described in NUREG-0800, Rev. 3
- **Uses AXIOM limit for rod ejection and models**
 - WCAP-18546-P, “Westinghouse **AXIOM** Cladding for Use in Pressure Water Reactor Fuel”

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Methodology & Approach

Rod Ejection and RG 1.236 Compliance

- **Transient Fission Gas Release Model**
 - Based on limiting enthalpy rise calculations
- **High Temperature Cladding Failure Limit**
 - Based on limiting rod internal pressure PAD5 calculations
- **PCMI Failure Criterion**
 - Based on limiting PAD5 corrosion calculations
- **Other Limits from RG 1.236**
 - DNBR failure for non-prompt critical initiated events
 - Burnup dependent fuel melt failure criterion
- **This analysis will confirm AST dose analysis inputs**
- **Coolability limits on fuel melt and peak enthalpy will be met**
- **Peak reactor coolant pressure < ASME Service Limit C**

Methodology & Approach

Spent Fuel Pool Criticality Analysis

- Current Analysis of Record was implemented ~10 years ago
- The updated analysis will:
 - Incorporate fuel management changes as a result of 24-month cycles
 - Burnable absorbers
 - Soluble boron during depletion
 - Axial profiles
 - Other important fuel design inputs (e.g., fuel density)
 - Include updated methodology
 - NEI-12-16, Revision 4 as endorsed by RG 1.240



Project Status

- **Project Kickoff November 2021**
- **Safety analysis impact assessments are ongoing**
 - Methodical review of all plant systems and safety analyses
 - Update analyses as-needed
- **Preliminary Analysis Impacts / Results**
 - Fluences and source terms found to be bounded
 - Radiological dose not expected to be impacted
 - Reanalyzed Containment analysis
 - Main Steam Line Break (MSLB)
 - Large Break LOCA (LBLOCA)

Proposed Schedule

Submit SFP Criticality LAR	June 2023
Submit 24-Month Fuel Cycle LAR (with attached AXIOM Exemption Request)	August 2023
Requested Approval for SFP Criticality LAR	July 2024
Requested Approval for 24-Month Fuel Cycle LAR	September 2024
24-Month Fuel Cycle Implementation for Unit 4	Spring 2025
24-Month Fuel Cycle Implementation for Unit 3	Spring 2026



Questions?