Calvert Cliffs
CEA Group Swap License Amendment Request

NRC Pre-application meeting

July 8, 2025

Agenda

- Introductions
- Meeting Objectives
- Purpose / Background Information
- Proposed Changes
- Preliminary Results and Limitations
- Timeline

Introductions

- Constellation - Corporate Licensing
- Constellation - Corporate Nuclear Fuels
- Constellation - Calvert Cliffs Regulatory Assurance
- Constellation - Calvert Cliffs Engineering
- Constellation - Calvert Cliffs Operations
- Framatome

Meeting Objectives

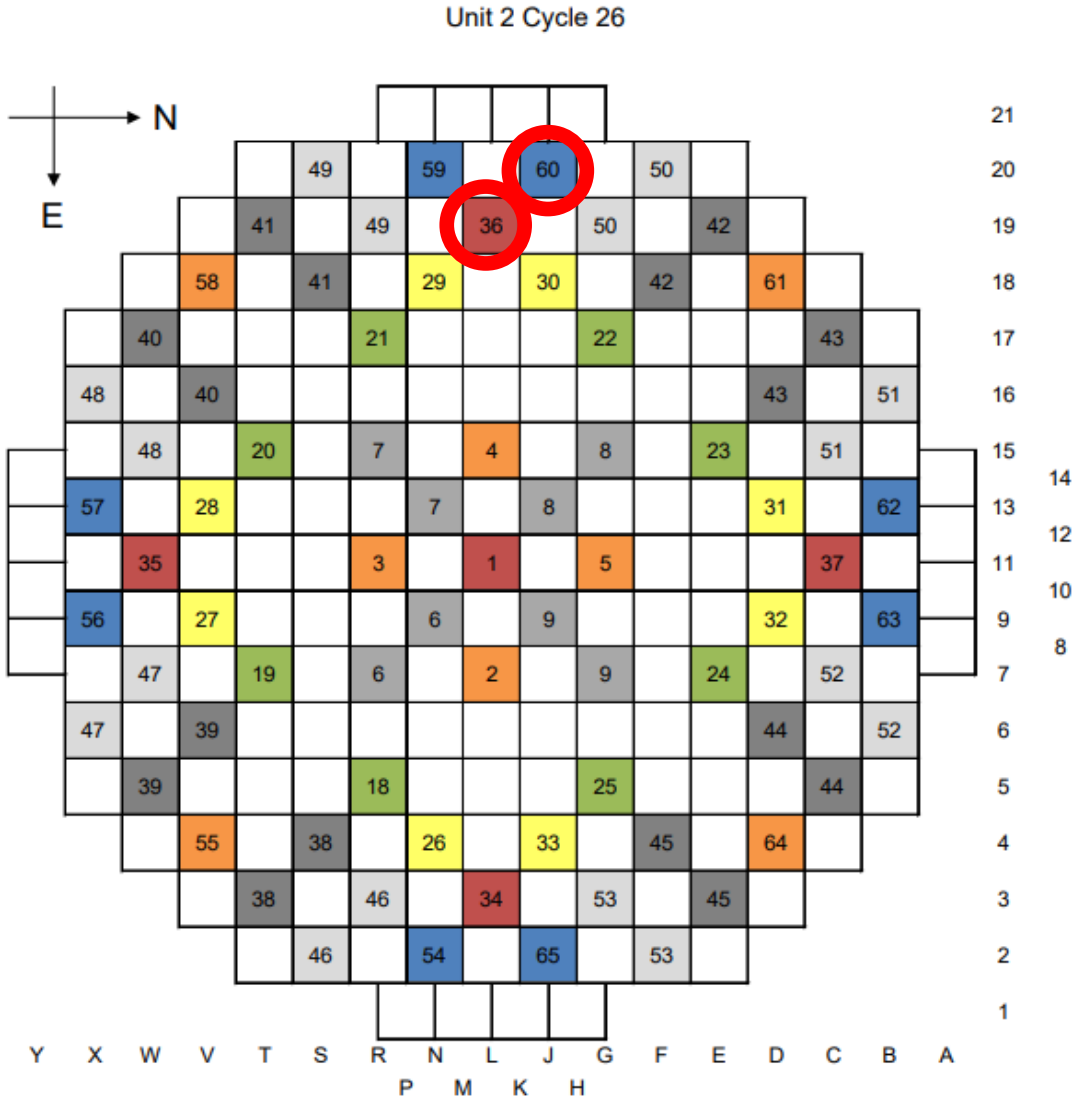
- Present information to NRC to enable a clear understanding of the overall project and proposed unit- and cycle-specific License Amendment Request (LAR) submittal
  - Calvert Cliffs one-time change to swap group for two Control Element Assemblies (CEAs) for Calvert Cliffs Unit 2 Cycle 26 (CC2C26), expected to end in February 2027.
- Obtain feedback from the NRC on the proposed LAR to ensure high quality submittal and minimize the need for RAIs
- Mutual understanding of the proposed schedule and corresponding need date in order to ensure adequate NRC resource availability

Purpose / Background Information

- Following startup of CC2C26 in April 2025, the upper gripper coil for CEA 36 (core location L-19, group 5) was determined to be failed, inhibiting CEA 36 motion.
  - The issue does not impact the ability for CEA 36 to fully insert when tripped.
  - CEA 36 is fully withdrawn and within 7.5 inches of other group 5 CEAs.
  - CEA-36 remains OPERABLE although it is not capable of moving to control power.
- Because CEA 36 is in group 5 (first group inserted to lower power), group 5 insertion is not possible due to Technical Specification (TS) 3.1.4 alignment requirements.
- CC2 is currently being operated with all CEAs fully withdrawn and only boration/dilution available to make reactivity changes.
- Using only boration/dilution is sufficient for reactor control early in the fuel cycle.
- As the Hot Full Power (HFP) Moderator Temperature Coefficient (MTC) becomes more negative through the fuel cycle, CEA motion availability is needed for optimal plant control, Axial Shape Index (ASI) control, and for the TS required 2/3 cycle MTC measurement due in June 2026.

Purpose / Background Information (cont.)

- In order to better respond to transient conditions, Calvert Cliffs is seeking approval to swap the CEA group assignment for CEA 36 (location L-19, group 5) and adjacent CEA 60 (location J-20, group 1) for the remainder of CC2C26.
- Prior to the swap, plant modifications would be performed to support this change.
- Following the swap, CEA 60 would move with group 5 and CEA 36 would move with group 1.
- This change, if approved, would only be applicable for CC2C26. The current / normal group assignments would be restored during the next planned or unplanned entry of Calvert Cliffs Unit 2 into MODE 3, 4, or 5.
- Similar precedent approved in ML010470133



Constellation

Purpose / Background Information (cont.)

- Technical Specification (TS) Limiting Condition for Operation (LCO) 3.1.4
  - All CEAs shall be OPERABLE and aligned to within 7.5 inches (indicated position) of their respective group, and the CEA motion inhibit and the CEA deviation circuit shall be OPERABLE.
- TS LCO 3.1.4 Bases
  - The limits on shutdown and regulating CEA alignments ensure that the assumptions in the safety analysis will remain valid...The OPERABILITY requirements...ensure that the CEA banks maintain the correct power distribution and CEA alignment. The requirement is to maintain the CEA alignment to within 7.5 inches between any CEA and its group. Failure to meet the requirements of this LCO may produce unacceptable power peaking factors and LHRs, or unacceptable SDMs, all of which may constitute initial conditions inconsistent with the safety analysis.
- TS SR 3.1.4.4
  - Verify CEA freedom of movement (trippability) by moving each individual CEA that is not fully inserted into the reactor core 7.5 inches in either direction.

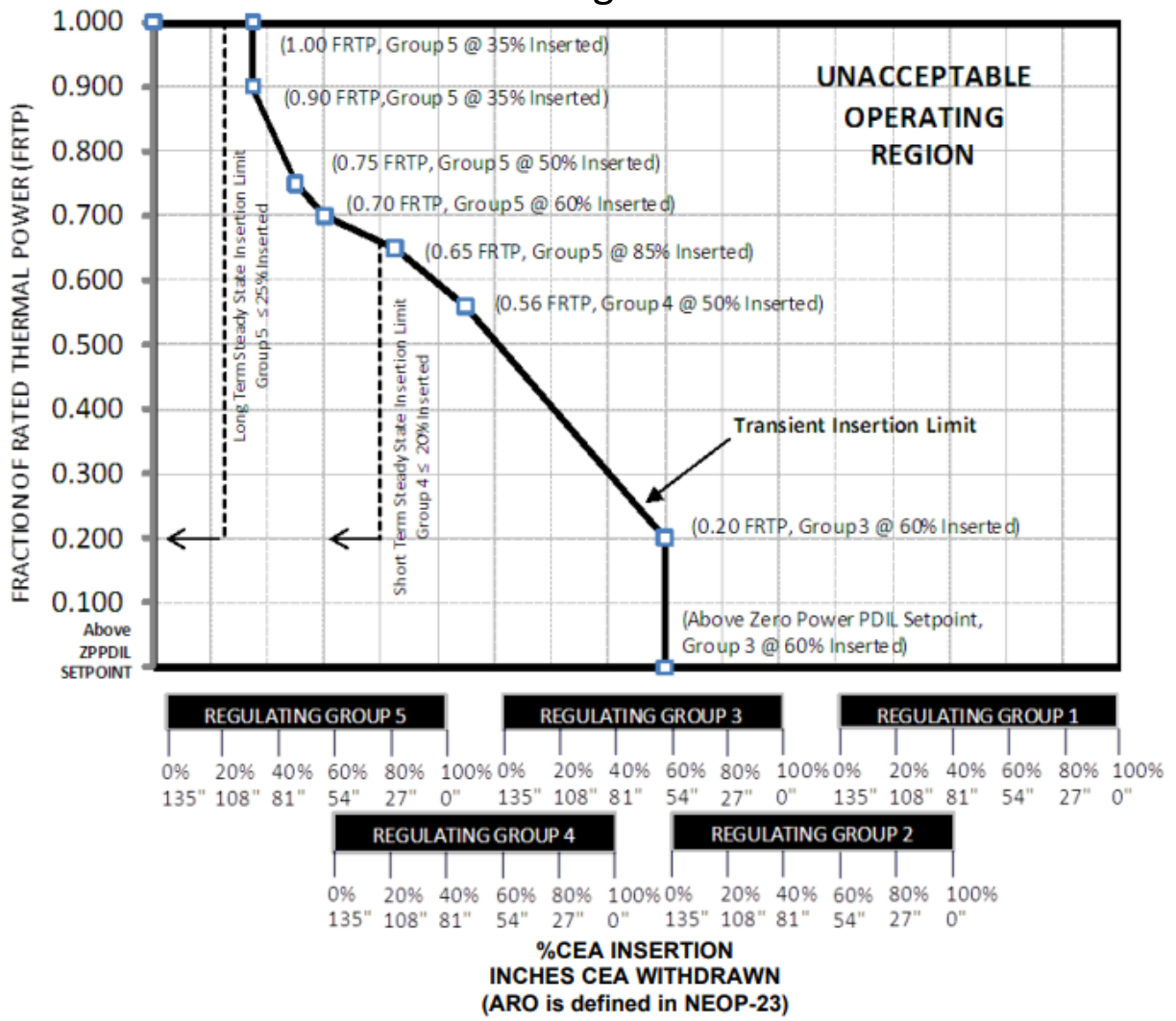
Purpose / Background Information (cont.)

- Calvert Cliffs Unit 2 License Condition from Amendment 273 (AREVA/Framatome Fuel Transition, ML110390224)
  - Power Level Sensitive Transient Analysis: Based on its review of the current CCNPP licensing basis, which includes a proprietary CE-generated analysis of the CEA withdrawal at various power levels, the NRC staff does not have sufficient information to conclude that the wide array of analyzed initial conditions is sufficiently conservative to account for possible transient variations in the core power distribution that may lead to more limiting DNBR conditions at lower power levels than are presently analyzed.
  - CEA Withdrawal at Power: The staff's finding is, however, based on the fact that the reference plant analysis is conservative when applied to CCNPP, because the CCNPP operating limits are more restrictive than those for the reference plant. The results do not, therefore, provide a CCNPP-specific basis to conclude that changes in the core operating limits are acceptable with respect to the part-power transients. The staff does not find EMF-2310 acceptable for implementation as a methodology to generate core operating limits for this and other power level sensitive transients.
  - CEA Drop: The NRC staff finds the requested fuel transition acceptable with respect to the dropped CEA event. This finding is based on an analyzed set of power-dependent peaking factor operating limits, and is subject to License Condition 4.

Purpose / Background Information (cont.)

- Calvert Cliffs Unit 2 License Condition from Amendment 273 (AREVA/Framatome Fuel Transition, ML110390224)
  - SE License Condition 4: Core Operating Limits Report (COLR) Figures 3.1.6, 3.2.3, and 3.2.5 shall not be changed without prior NRC review and approval until an NRC-accepted generic, or Calvert Cliffs-specific, basis is developed for analyzing the Control Element Assembly Rod Bank Withdrawal Event, the Control Element Assembly Drop, and the Control Element Assembly Ejection (power level-sensitive transients) at full power conditions only.
  - Although Figures 3.1.6, 3.2.3, and 3.2.5 are not expected to be updated as part of the proposed change, a change to CEA group assignments is considered a change impacting the analyses that resulted in the need for this License Condition. Therefore, Constellation is seeking approval for the proposed CEA group change consistent with this License Condition.

COLR Figure 3.1.6



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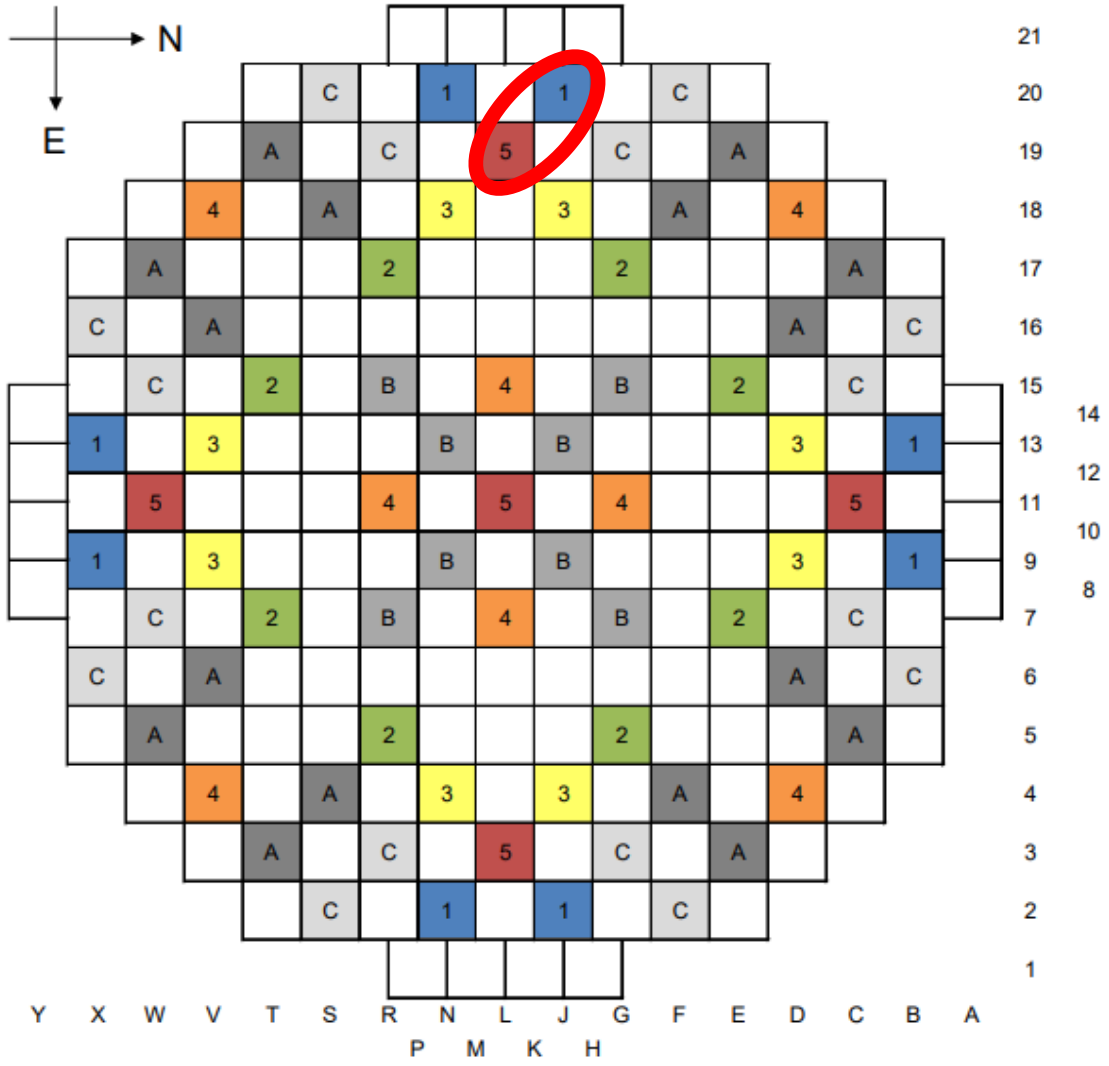
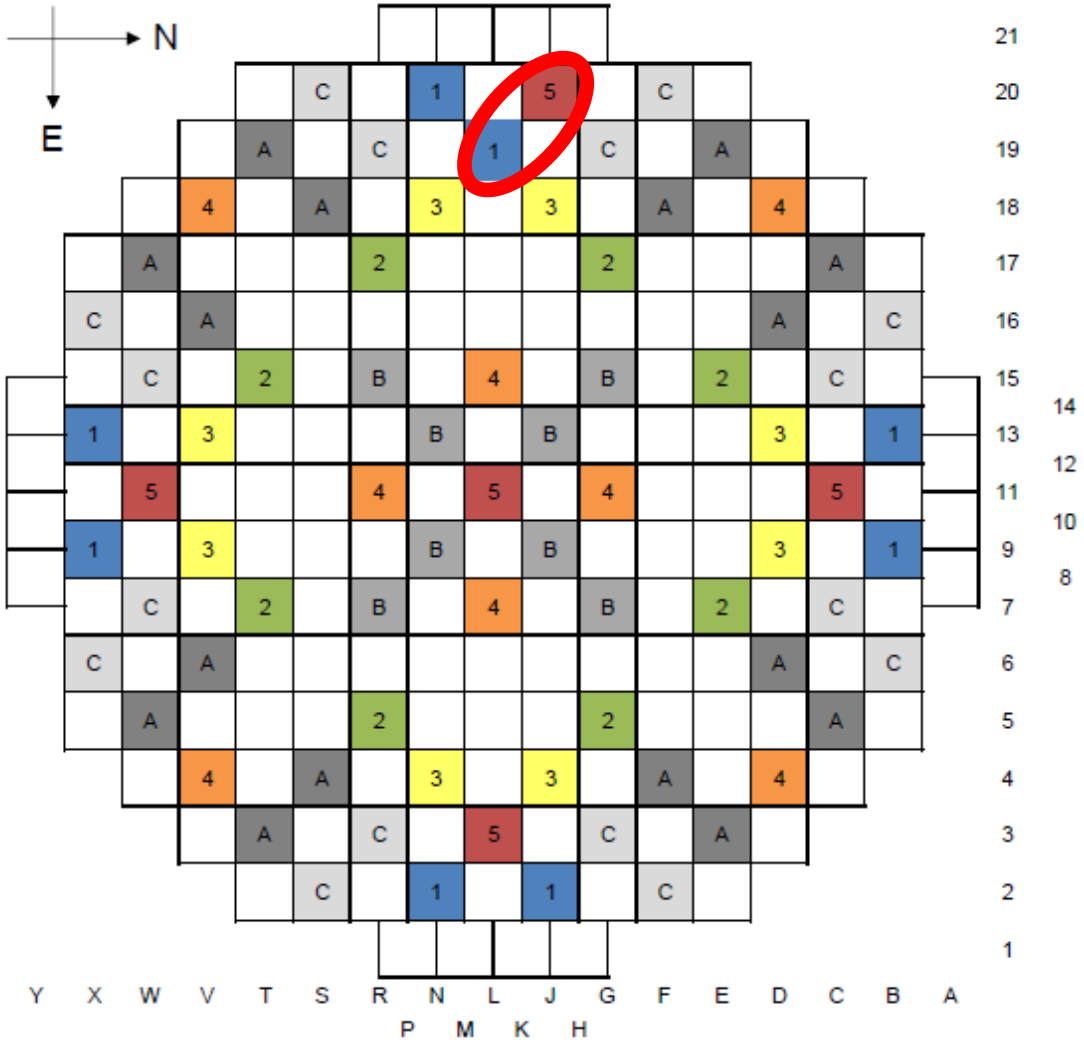
Proposed Changes

Current CEA Groups



Proposed CEA Groups



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Preliminary Results and Limitations

- Framatome completed preliminary neutronics and safety analyses for the proposed CEA group swap
- Analyses were performed in accordance with the current approved TS 5.6.5.b analytical methods. No changes to approved methodologies are required.
- A Misload re-analysis is not required because the cycle has already started.
- Preliminary results
  - Neutronics: All analyses show passing margin. CEA configuration introduces a core power tilt when control rods are inserted. Analysis has shown that the 3% azimuthal tilt limit (LCO 3.2.4) will be exceeded at deeper Power Dependent Insertion Limit (PDIL) positions. Because of this, F_r^T will need to be verified once every 8 hours.
  - Thermal-Hydraulics (TH): Most of the analyses saw a decrease in margin due to more challenging PDIL and Long Term Insertion Limit (LTIL) axials with the swapped CEA. All analyses show passing margin with the exception of the Local Power Density (LPD) LCO Setpoint Verification, which may require a COLR Figure 3.2.1-2 (Linear Heat Rate Axial Flux Offset Control Limits) revision.

Preliminary Results and Limitations (cont.)

- Preliminary results (cont.)
  - Loss of Coolant Accident (LOCA): All analyses show passing margin. There were no challenges to the Realistic Large Break LOCA (RLBLOCA) and Small Break LOCA (SBLOCA) neutronics parameters.
  - Non-LOCA: For non-LOCA analyses, CEA withdrawal at low power could not support cases at or below 1% Rated Thermal Power (RTP), meaning that operation in Mode 2 with the alternate CEA configuration must be limited to a minimum power of 1% RTP. All other non-LOCA analyses show passing margin.
  - Thermal-Mechanical (TM): Analyses were completed using the RODEX2 methodology to support all fuel in the core except the Accident Tolerant Fuel (ATF) Lead Test Assembly (LTA) fuel. The ATF LTA fuel was analyzed using COPERNIC. The results and conclusions from the existing CC2C26 RODEX2 and COPERNIC analyses were determined to remain valid.

Preliminary Results and Limitations (cont.)

- Preliminary results (cont.)
  - POWERTRAX (Core Monitoring): Several changes are required to support the proposed CEA group swap, including updates to Peripheral Axial Shape Index (ASI) weighting factors, plant computer data points, and CEA Bank configuration in the PRISM model. With these changes implemented, the current version of POWERTRAX will be able to perform its function to support TS surveillances. These changes can be implemented with CC2 at power.
  - ATF LTA impacts: CC2C26 includes one ATF LTA in core location A-8 (peripheral location on North side of core). No impacts to the LTA are expected based on the proposed CEA swap in locations L-19 and J-20 (West side of core).

Preliminary Results and Limitations (cont.)

- Based on preliminary results, the following open items still exist. These items will be addressed as part of the completion of Framatome QA'd analyses.
  - If the CEA alignment is restored during CC2C26, Framatome may need to re-assess the validity of the licensing basis analysis prior to a return to power.
  - COLR Figure 3.2.1-2 (Linear Heat Rate Axial Flux Offset Control Limits), including associated alarm setpoints, may need to be revised. This Figure is only used if the ICI system is out of service, which requires LHR to be monitored with excore detectors. This COLR figure change would not require NRC approval.

Preliminary Results and Limitations (cont.)

- Based on preliminary results, the following limitations are expected:
  - If CC2 enters modes 3, 4, or 5 at any time during CC2C26, the damaged CEA must be repaired, and the current / normal group assignments would be restored.
  - Operation at <1% RTP in MODE 2 is not allowed based on analyses of CEA withdrawal at these conditions. If power falls below 1% RTP, the unit must be taken to a lower mode in order to repair the damaged CEA and the current / normal group assignments would be restored.
  - Deep power reductions via CEA insertion may cause core tilt to exceed the 3% limit, with the action requirement of F_r^T verification to be performed once every 8 hours. The core tilt limit of 10% will not be challenged.

Timeline

- Framatome completion of final analyses supporting LAR – 10/15/2025
- Constellation submittal of LAR – 10/27/2025
- Requested NRC License Amendment approval – 12/01/2025
- License Amendment implementation – 01/30/2026

Note: Constellation and Framatome are willing to support an NRC audit to help expedite the NRC review of the proposed change.