

TVA Sequoyah RFA-2 Fuel Transition & Westinghouse Methods Implementation

NRC Staff Remarks

Purpose of Discussion

- TVA plans to request changes to Sequoyah (SQN) Technical Specifications (TS) necessary to:
 - Use Westinghouse RFA-2 Fuel
 - Implement Westinghouse fuel analysis, safety analysis, and surveillance methods
 - Relocate a fuel melt safety limit (SL) to the Core Operating Limits Report (COLR)
- TVA proposes to reduce the scope of NRC staff review relative to a routine fuel and safety analysis vendor transition request
- TVA has requested NRC staff feedback

Key Messages

- NRC staff considered three options in detail:
 - TVA's proposal
 - Routine fuel transition review
 - Hybrid of two options listed above
- NRC staff must be able to verify independently that the proposed fuel and analytic methods transition could be implemented at Sequoyah in conformance with NRC requirements
 - NRC staff needs to verify that TVA satisfies applicable conditions and limitations associated with the requested analytic methods
 - NRC staff needs to verify that Sequoyah-specific analyses meet applicable safety analysis and regulatory acceptance criteria
 - Review scope needed to accomplish verification more closely aligns with a routine fuel transition review than the TVA proposal
- NRC staff believes that TVA's proposal to relocate TS fuel melt SL to COLR would be unlikely to satisfy 10 CFR 50.36 requirements

Applicable Regulatory Requirements

- Fuel and safety analysis methods affect compliance with numerous regulatory requirements
- 10 CFR 50.36 provides requirements for Technical Specifications
- Generic Letter 1988-16 requires that methods used to determine cycle-specific parameter limits be referenced in the TS, which are subject to NRC staff review and approval prior to plant-specific implementation
- 10 CFR 50.46 provides specific requirements for ECCS performance analysis:
 - Calculated ECCS performance must conform to the requirements set forth in paragraph (b) of 10 CFR 50.46
 - ECCS cooling performance must be calculated in accordance with an acceptable evaluation model
- General Design Criteria apply:
 - Fuel transition and associated analytic methods implementation will change the way that SQN demonstrates compliance with GDCs 10, 11, 12, 13, 15, 20, 25, 26, 27, 28, 31, and 35

Staff Review Approach

- Verify proposed analytic methods are applicable to SQN
 - Applicable conditions and limitations are satisfied
 - Implementation is generally consistent with approving staff SE
- Verify SQN-specific analyses meet applicable analytic limits
- Combination of approved methods, acceptable implementation, and acceptable results provides reasonable assurance that new fuel design and safety analysis can be implemented in conformance with NRC requirements, including 10 CFR 50.46(b) acceptance criteria and applicable GDCs or proposed GDC published in 1967.

Example Methodology

Implementation: FSLOCA™

- NRC staff review verifies that 15 Conditions/Limitations are satisfied
- Several Conditions/Limitations clearly indicate anticipated NRC review activity; examples include:
- Limitation 2: “Plant-specific licensing actions referencing FSLOCA™ analyses should include a statement summarizing the extent to which the FSLOCA methods and modeling were followed, and justification for any departures. Should NRC staff review determine that absolute adherence to the modeling guidelines is inappropriate for a specific plant, additional information may be requested using the RAI process.”
- Limitations 9 and 10 require design-specific confirmatory studies, the results of which require NRC staff review prior to the first 4-Loop Westinghouse PWR implementation of FSLOCA™
- Limitation 11: “Should a plant-specific application of the FSLOCA™ EM deviate from the originally declared analysis inputs for the purpose of demonstrating compliance with the applicable acceptance criteria, all modification(s) will be discussed in a calculation file and in [emphasis added] **the ECCS analysis submittal to the NRC**, as applicable, to explain the applicable reasons for the modification(s).” [...] “Furthermore, operating ranges used in a plant-specific analysis as part of the sampling uncertainty analysis for Regions I and II are to be supplied [emphasis added] **for review by the NRC** in a table format for both regions.”
- The SQN-specific results are needed to provide assurance that calculated ECCS performance conforms to the criteria contained in paragraph (b) of 10 CFR 50.46

Other Examples

- WCAP-17661P-A provides a revised method for formulating the F_Q surveillance
 - The approving safety evaluation includes two limitations
 - Application of prior methods for F_Q surveillance would require NRC staff verification that NSAL 09-5 has been adequately addressed
 - Either approach would require NRC staff review
- Revised Thermal Design Procedure includes 7 methodology restrictions documented in SE
- VIPRE-02 SE includes 4 conditions, stating, “The NRC staff will require licensees referencing this topical report in licensing actions to document how these conditions are met.”

Analytic Results

- A portion of regulatory compliance depends on acceptable implementation of NRC-approved methods, with applicable limitations and conditions satisfied
 - GDC 35 single failure criterion is addressed by complying with FSLOCA™ Limitation 15
 - Analytic assumptions for the main steamline break accident analysis address portions of GDC 26, i.e., “...with appropriate margin for stuck rods.”
- Meeting acceptance criteria provides assurance that remaining aspects of GDC and other regulatory requirements are satisfied. Examples:
 - DNB analyses for AOOs assure that GDC 10 is satisfied, regarding not exceeding specified acceptable fuel design limits, with appropriate margin for conditions of normal operation, including the effects of anticipated operational occurrences
 - Adherence to fuel melt and enthalpy addition limits assure that GDC 26-28 are satisfied, concerning not exceeding specified acceptable fuel design limits, or assuring the ability to cool the core is maintained
 - The results of an acceptable ECCS evaluation assure that 10 CFR 50.46 acceptance criteria are met

Concluding Remarks

- A complete submittal to justify the TS changes necessary to transition the fuel and safety analysis to new fuel includes:
 - (1) appropriate justification to implement the methods, and
 - (2) analytic results applicable to the proposed fuel design.
- NRC staff independently verifies that proposed changes meet applicable requirements and design criteria, and that proposed analysis methods are applicable and properly implemented.
- Staff reaches its reasonable assurance determination after reviewing results to determine that applicable regulations will be met, and prior to methods implementation.
- Given TVA's Fall 2022 need date, the fuel and methods transition can be supported by using the existing process, given a complete LAR is submitted which includes the analytic results.
- There is less schedule and cost uncertainty associated with the well-established review process than what TVA proposed.

Annex 1: Prior Fuel Transition Reviews

- Prior efforts with reasonably complete submittals include:
 - Monticello request to implement AREVA fuel and safety analysis methods; ML13200A185
 - Dresden/Quad Cities request to implement AREVA fuel and safety analysis methods; ML15055A154
 - Palo Verde Nuclear Generating Station request to implement Next Generation Fuel; ML16188A336

Annex 2: Review Efficiencies

- Opportunities to increase the SQN review efficiency:
 - Assign staff experienced with recent fuel transition reviews, and with the specific methods TVA proposes to implement
 - Leverage regulatory audits where appropriate
 - Use of recently approved methods can reduce regulatory uncertainty, e.g.:
 - PAD5 and FSLOCA reduce review effort required to assure that nuclear fuel thermal conductivity degradation is appropriately addressed
 - WCAP-17661 reduces review effort required to assure that NSAL 09-5 is addressed