



License Amendment Request for Sequoyah Nuclear Plant Unit 1 Operation Without Rod Cluster Control Assembly at Core Location H-08 During Cycle 25

Pre-Submittal Meeting
February 20, 2020

Introductions

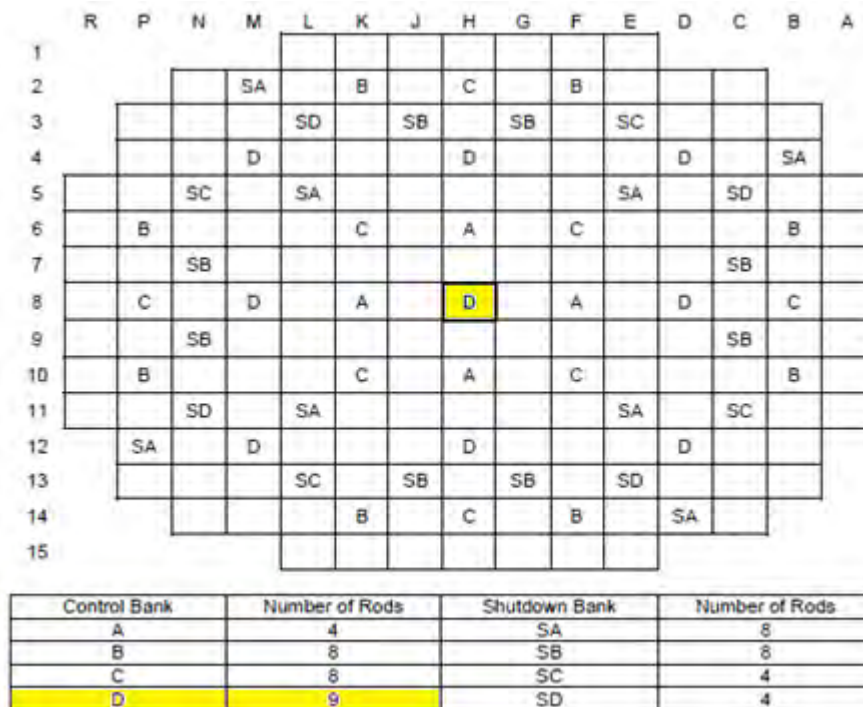
- Kim Hulvey and Gordon Williams – TVA Licensing
- David Brown – TVA General Manager, Reactor Engineering and Fuels
- Chris Carey and Kasey Decker – TVA Nuclear Safety Analysis
- Jim Smith – Westinghouse Licensing
- Framatome (on the Phone) – Individuals will introduce themselves when answering questions



Objectives

- Overview of H-08 and history
- Impacts of H-08 removal
- Insights from U1C24 exigent LAR
- Considerations
- LAR Content
- Schedule
- Answer NRC questions

Rod Cluster Control Assembly Overview



- SQN Units originally had 53 Rod Control Cluster Assemblies (RCCAs)
- RCCAs are grouped into Banks:
 - Four Shutdown Banks
 - Four Control banks
- The H-08 RCCA was part of Control Bank D and located in the center of the core.

History

- Wear on the grippers for the SQN Unit 1 H-08 RCCA resulted in the RCCA dropping into the core on several occasions
- Exigent Licensing Amendment Request (LAR) to remove H-08 RCCA for one cycle (U1C24) approved November 21, 2019
- The H-08 RCCA and associated drive shaft were removed and replaced with a flow restrictor to maintain upper head flow
- Control power to stationary and moveable gripper coils for the H-08 RCCA as well as display and alarm functions have been removed

Key Parameters Impacted by H-08 Removal

Parameter
Bypass Flow
Shutdown Margin (SDM)
Most Reactive Stuck Rod Worth
Boron Concentration and Worth
Trip Reactivity vs Rod Insertion
Moderator Temperature Coefficient (MTC)
Delayed Neutron Data
Doppler Temperature Coefficients
Fuel Temperatures

Insights from the U1C24 LAR

- The magnitudes of the impacts to the key parameters (small or insignificant) can be seen directly from the information provided in the exigent LAR (LAR dated 11/16/19, SE dated 11/21/19)
- The U1C24 core was designed assuming all 53 control rods were present. The LAR demonstrated margin to the safety limits with the H-08 RCCA removed.
- The standard reload methodology can be used to design a core without the H-08 RCCA that has margin to all safety limits

Insights from the U1C24 LAR (continued)

- Trip reactivity decreased due to the removal of the H-08 RCCA, but still above the trip reactivity credited in the safety analysis
- Required boron concentration for SDM increased by less than 110 ppm
- The margin to the safety analysis limits generally increased as a result of the removal of the H-08 RCCA -- the improvement is attributed to the power shifting towards the center of the core

Considerations

- Replacement of the control rod drive mechanism (CRDM) is a major effort
 - Personnel dose
 - Long lead activity with first-of-a-kind elements
 - Custom tooling, processes, crew qual. on mockups, etc.
- In contrast, removal of the H-08 RCCA can be accommodated in the safety analyses with margin
- Eliminating the H-08 RCCA from core design is the optimal solution

Considerations (continued)

- Cycle 25 will be the last Unit 1 core that uses Framatome methods
 - Cycle 26 and beyond will be designed/analyzed using Westinghouse methods (upcoming fuel transition)
 - Efforts to justify permanent removal of the H-08 RCCA via Framatome methods would have to be repeated using Westinghouse methods
- TVA intends to request an extension of the H-08 RCCA removal for U1C25
- Address permanent removal of the H-08 RCCA via Fuel Transition LAR

Considerations (continued)

- Explicit evaluation of the H-08 RCCA removal for U1C25 will not be available until just before the start of the refueling outage (Spring 2021)
- Insights from the **U1C24** exigent LAR show that removal of the H-08 RCCA can be accommodated in the core design
- An in-progress **U2C24** margin assessment will further demonstrate that removal of the H-08 RCCA can be accommodated
- The U2C24 margin assessment will be available much earlier than the U1C25 evaluation
 - Provides ~1 year for LAR review

LAR Content

- Information provided for the U1C24 exigent LAR will be provided for U2C24
 - LAR will be provided in time for an approximate one year NRC review
 - The U1C24 and U2C24 cores are similar in design to the expected design of the U1C25 core (i.e., similar energy requirements, feed batch size and enrichment)
 - The U1C25 analysis results will not vary appreciably from the U1C24 and U2C24 results
 - The U1C24 and U2C24 cores demonstrate that a core designed assuming 53 controls rods can still meet all required safety analysis acceptance criteria with the H-08 RCCA removed
 - Designing the U1C25 core with the H-08 RCCA removed assures the U1C25 core design will meet all acceptance criteria.
- The U1C24 and U2C24 margin assessments form the technical justification for the Unit 1 H-08 RCCA removal extension

LAR Content (continued)

- SQN U1 Proposed TS 4.2.2 Markup

4.2.2 Control Rod Assemblies

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-----NOTE-----
Operation with 52 full length control rod assemblies (with no control rod assembly installed in core location H-08) is permitted during Cycle 24.

The reactor core shall contain 53 full length and no part length control rod assemblies. The full length control rod assemblies shall contain a nominal 142 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium, and 5 percent cadmium. All control rods shall be clad with stainless steel tubing.

Schedule

Date	Milestone
April 2020	LAR submittal date
March 2021	Requested approval
Prior to U1C25 startup	Implementation



Closing and Questions