Watts Bar Nuclear Plant

Pre-Submittal Teleconference for Proposed License Amendment Request Regarding Application to Revise Watts Bar Nuclear Plant Units 1 and 2 Technical Specifications and 10 CFR 50.12 Exemption Request to Implement Optimized ZIRLO™ Fuel Rod Cladding

June 19, 2018

Agenda

- Opening Remarks and Purpose of the Proposed License Amendment Request (LAR) and Exemption Request
- Proposed Technical Specification Changes
- Technical Analysis of the Proposed LAR and Exemption Request
- Regulatory Precedent
- Schedule for Submittal
- Summary and Closing Remarks

Opening Remarks and Purpose of the Proposed LAR and Exemption Request

- The proposed Technical Specification (TS) amendment revises the WBN Units 1 and 2 TS 4.2.1, “Fuel Assemblies,” and 5.9.5, “Core Operating Limits Report (COLR),” to allow the use of Optimized ZIRLO™[1] as an approved fuel rod cladding material.
- The license amendment request (LAR) is consistent with the Nuclear Regulatory Commission (NRC) safety evaluation that approved the use of Optimized ZIRLO fuel rod cladding material as documented in WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A (Proprietary) and WCAP-14342-A and CENPD-404-NP-A (Non-Proprietary).
- In support of this LAR, an exemption request is also being submitted in accordance with 10 CFR 50.12, "Specific exemptions,” from certain requirements of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR 50, Appendix K, "ECCS Evaluation Models."

1. Optimized ZIRLO is a trademark of Westinghouse Electric Company LLC

Proposed WBN 1 & 2 TS 4.2.1 Changes

4.0 DESIGN FEATURES

4.1 Site

4.1.1 Site and Exclusion Area Boundaries

The site and exclusion area boundaries shall be as shown in Figure 4.1-1.

4.1.2 Low Population Zone (LPZ)

The LPZ shall be as shown in Figure 4.1-2 (within the 3-mile circle).

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 193 fuel assemblies. Each assembly shall consist of a matrix of Zircaloy, ~~or~~ ZIRLO~~rle~~®, or Optimized ZIRLO™ clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions. For Unit 1 Watts Bar is authorized to place a maximum of 1792 Tritium Producing Burnable Absorber Rods into the reactor in an operating cycle.

4.2.2 Control Rod Assemblies

The reactor core shall contain 57 control rod assemblies. The control material shall be either silver-indium-cadmium or boron carbide with silver indium cadmium tips as approved by the NRC.

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4.2.2 Control Rod Assemblies

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Proposed WBN 1 & 2 TS 5.9.5 Changes

5.9 Reporting Requirements

5.9.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

3. WCAP-10216-P-A, Revision 1A, "RELAXATION OF CONSTANT AXIAL OFFSET CONTROL F(Q) SURVEILLANCE TECHNICAL SPECIFICATION," February 1994 (W Proprietary). (Methodology for Specifications 3.2.1 - Heat Flux Hot Channel Factor (W(Z) Surveillance Requirements For F(Q) Methodology) and 3.2.3 - Axial Flux Difference (Relaxed Axial Offset Control).)

4. WCAP-12610-P-A, "VANTAGE + FUEL ASSEMBLY REFERENCE CORE REPORT," April 1995. (W Proprietary). (Methodology for Specification 3.2.1 - Heat Flux Hot Channel Factor).

5. WCAP-15088-P, Rev. 1, "Safety Evaluation Supporting A More Negative EOL Moderator Temperature Coefficient Technical Specification for the Watts Bar Nuclear Plant," July 1999, (W Proprietary), as approved by the NRC staff's Safety Evaluation accompanying the issuance of Amendment No. 20 (Methodology for Specification 3.1.4 - Moderator Temperature Coefficient.).

6. Caldon, Inc. Engineering Report-80P, "Improving Thermal Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM✓™ System," Revision 0, March 1997; and Caldon, Inc. Engineering Report-160P, "Supplement to Topical Report ER-80P: Basis for a Power Uprate With the LEFM✓™," Revision 0, May 2000; as approved by the NRC staff's Safety Evaluation accompanying the issuance of Amendment No. 31.

7. WCAP-11397-P-A, "Revised Thermal Design Procedure," April 1989. (Methodology for Specification 3.2.2 - Nuclear Enthalpy Rise Hot Channel Factor).

8. WCAP-15025-P-A, "Modified WRB-2 Correlation, WRB-2M, for Predicting Critical Heat Flux in 17 x 17 Rod Bundles with Modified LPD Mixing Vane Grids," April 1999. (Methodology for Specification 3.2.2 - Nuclear Enthalpy Rise Hot Channel Factor).

9. WCAP-14565-P-A, "VIPRE-01 Modeling and Qualification for Pressurized Water Reactor Non-LOCA Thermal-Hydraulic Safety Analysis," October 1999. (Methodology for Specification 3.2.2 - Nuclear Enthalpy Rise Hot Channel Factor).

10. WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™."

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

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5.9 Reporting Requirements

5.9.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

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9a. WCAP-12472-P-A, "BEACON™ CORE MONITORING AND OPERATIONS SUPPORT SYSTEM," August 1994, (W Proprietary). (Methodology for Specification 3.2.1 – Heat Flux Hot Channel Factor, and 3.2.2 – Nuclear Enthalpy Rise Hot Channel Factor).

9b. WCAP-12472-P-A, Addendum 1-A, "BEACON™ MONITORING AND OPERATIONS SUPPORT SYSTEM," January 2000, (W Proprietary). (Methodology for Specification 3.2.1 – Heat Flux Hot Channel Factor, and 3.2.2 – Nuclear Enthalpy Rise Hot Channel Factor).

9c. WCAP-12472-P-A, Addendum 2-A, "BEACON™ MONITORING AND OPERATIONS SUPPORT SYSTEM (WCAP-12472-P-A) Addendum 2," April 2002, (W Proprietary) (Methodology for Specification 3.2.1 – Heat Flux Hot Channel Factor, and 3.2.2 – Nuclear Enthalpy Rise Hot Channel Factor).

9d. WCAP-12472-P-A, Addendum 4, "BEACON™ CORE MONITORING AND OPERATIONS SUPPORT SYSTEM, Addendum 4," September 2012, (W Proprietary) (Methodology for Specification 3.2.1 – Heat Flux Hot Channel Factor, and 3.2.2 – Nuclear Enthalpy Rise Hot Channel Factor).

10 WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™."

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Technical Analysis of the Proposed LAR

- Optimized ZIRLO was developed to meet the needs of longer operating cycles with increased fuel discharge burnup and fuel duty.
- Compared to ZIRLO®[2], the lower tin content and microstructure difference of Optimized ZIRLO provides a reduced corrosion rate while maintaining the benefits of mechanical strength and resistance to accelerated corrosion from abnormal chemistry conditions.
- Optimized ZIRLO scheduled to be loaded in the WBN Unit 2 Fall 2020 Refueling Outage (U2R3) and the WBN Unit 1 Fall 2021 Refueling Outage (U1R17).

2. ZIRLO is a registered trademark of Westinghouse Electric Company LLC

Technical Analysis of the Proposed LAR

- Optimized ZIRLO evaluated and approved by the NRC in their Safety Evaluation (SE) (ML051670403) for WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A .
- The LAR (Enclosure 1 to the submittal) addresses each of the 10 conditions in the NRC SE. Exceptions are:
  - NRC Condition 8b, WBN uses a Westinghouse fuel design and not a CE fuel design; therefore, Condition 8.b does not apply.
  - NRC Condition 9, WBN is not licensed to use the LOCBART or STRIKIN-11 codes.

Technical Analysis of the Proposed LAR

- Section 3.2 of the LAR addresses the effect of Optimized ZIRLO on ongoing WBN licensing actions
  - TVA submitted a LAR to NRC on 3/5/18 (ML18064A192) for WBN Unit 2 to permit continued use of the PAD4TCD computer program to continue to establish core operating limits until the WBN Unit 2 steam generators (SGs) are replaced.
  - TVA submitted a LAR to NRC on 12/20/17 (ML17354B282) to authorize the use of TPBARs in the WBN Unit 2 reactor core.
  - The use of Optimized ZIRLO is bounded by the analyses that support these licensing actions.

Exemption Request

- The 10 CFR 50.46 and 10 CFR 50, Appendix K regulations are currently limited in applicability to the use of fuel rods with zircaloy or ZIRLO cladding. 10 CFR 50.46 and 10 CFR 50, Appendix K do not apply to the proposed use of Optimized ZIRLO fuel rod cladding material because Optimized ZIRLO has a slightly different composition than zircaloy or ZIRLO.
- Pursuant to 10 CFR 50.12, the requested exemption is authorized by law, does not present undue risk to public health and safety, and is consistent with the common defense and security. Approval of this exemption request does not violate the underlying purpose of the rule. In addition, special circumstances exist to justify the approval of an exemption from the subject requirements.

Exemption Request

- The exemption request addresses Criteria 1 and 2 of 10 CFR 50.12, "Specific exemptions."
- Criterion 1
  - This exemption is authorized by law.
  - This exemption will not present an undue risk to public health and safety.
  - This exemption is consistent with the common defense and security.
- Criterion 2 - Special circumstances support the issuance of an exemption.
  - 10 CFR 50.12(a)(2)(ii), "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule."
  - For WBN, application of the subject regulations is not necessary to achieve the underlying purpose of the rule.

Technical Analysis of the Exemption Request

- The exemption request (Enclosure 2 to the submittal) regards the provisions of 10 CFR 50.46, and 10 CFR 50, Appendix K.
  - 10 CFR 50.46 contains acceptance criteria for the emergency core cooling system (ECCS) for reactors that have fuel rods fabricated either with zircaloy or ZIRLO fuel rod cladding material.
  - Concurrently, 10 CFR 50, Appendix K.I.A.5, requires the Baker-Just equation be used to calculate the rate of energy release, hydrogen generation, and cladding oxidation from the metal-water reaction in the core. The Baker-Just equation assumes the use of a zirconium alloy other than Optimized ZIRLO™ material.
  - The exemption request relates solely to the specific cladding material identified in the above regulations (fuel rods with zircaloy or ZIRLO cladding) and will provide for the application of 10 CFR 50.46 and 10 CFR 50, Appendix K acceptance criteria to fuel assembly designs utilizing Optimized ZIRLO fuel rod cladding at WBN Units 1 and 2.

Technical Analysis of the Exemption Request

Supporting information for the Exemption Request includes:

- Compliance with the conditions in the NRC SE for WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A.
- Future reload evaluations will ensure that acceptance criteria are met for the insertion of fuel assemblies composed of fuel rods clad with Optimized ZIRLO These fuel assemblies will be evaluated using NRC-approved methods and models.
- Application of the Baker-Just equation has been demonstrated to be appropriate for Optimized ZIRLO. Due to the similarities in material composition of the Optimized ZIRLO and ZIRLO fuel rod cladding, the application of the Baker-Just equation will continue to conservatively bound all post-LOCA scenarios.

Regulatory Precedent

- This LAR and exemption request are similar in nature to the following LARs and exemption requests approved by the NRC that authorized the use of Optimized ZIRLO fuel rod cladding:
  - Beaver Valley Power Station, Unit Nos. 1 and 2 (ML18022B116 and ML17313A550 dated 3/1/18)
  - Palo Verde Nuclear Generating Station, Units 1, 2, and 3 (ML17319A207 and ML17319A103 dated 1/23/18)
  - R.E. Ginna Nuclear Power Plant (ML17131A066 and ML17131A113 dated 6/21/17)
  - Wolf Creek Generating Station (ML16179A293 and ML16179A440 dated 8/2/16)
  - Seabrook Station, Unit No. 1 (ML13213A143 and ML13213A074 dated 3/5/14)
- RAIs associated with the above submittals (as applicable) were reviewed

Schedule for Submittal

- June 19, 2018 – Pre-submittal teleconference with NRC
- August 3, 2018 - Submit LAR to NRC
- Request NRC approval within one year from the date of submittal with a 30-day implementation date
  - Supports schedule for planning activities for the U2R3 Refueling Outage and the U1R17 Refueling Outage.
- September 2018 – Telecon or meeting to discuss any NRC questions (if needed)

Closing Remarks

- Proposed LAR and exemption request will allow the use of Optimized ZIRLO as an approved fuel rod cladding material.

- Proposed LAR and exemption request provides reasonable assurance that the health and safety of the public will not be endangered.


TVA