TENNESSEE VALLEY AUTHORITY

1101 Market Street, Chattanooga, Tennessee 37402

CNL-21-011

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10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant Unit 2
Facility Operating License No. NPF-96
NRC Docket No. 50-391

Subject: **Expedited Application for Approval to Use a Growth Rate Temperature Adjustment When Implementing the Generic Letter 95-05 Analysis for the Watts Bar Nuclear Plant (WBN), Unit 2 Steam Generators (WBN TS-391-21-002)**

Reference: NRC letter to TVA, "Watts Bar Nuclear Plant, Unit 2 - Issuance of Amendment No. 48 Regarding Use of Alternate Probability of Detection Values for Beginning of Cycle in Support of Operational Assessment (EPID L-2020-LLA-0273)," dated February 9, 2021 (ML21027A167)

In accordance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.90, "Application for amendment of license, construction permit, or early site permit," Tennessee Valley Authority (TVA) is submitting a request for an amendment to Facility Operating License No. NPF-96 for the Watts Bar Nuclear Plant (WBN) Unit 2.

In the referenced letter, the Nuclear Regulatory Commission (NRC) approved a license amendment for WBN Unit 2 to revise the WBN dual-unit Updated Final Safety Analysis Report (UFSAR) to apply an eddy current probability of detection (POD) of 0.9 to indications of axial outside diameter stress corrosion cracking (ODSCC) at tube support plates (TSP) with bobbin voltage amplitudes of greater than or equal to (≥) 3.2 volts, but less than (<) 6.0 volts and a POD of 0.95 to indications of ≥ 6.0 volts in the WBN Unit 2 steam generators (SG) for the beginning of cycle (BOC) voltage distribution in support of the WBN Unit 2 operational assessment (OA).

Based on the OA performed by TVA utilizing the above POD values, TVA is required to do a mid-cycle outage of WBN Unit 2 in August 2021 to perform an inspection of the WBN Unit 2 SGs. Performing a mid-cycle outage in August 2021 is not desirable due to high peak electrical load demands. Therefore, the proposed license amendment request (LAR) further revises the WBN UFSAR to apply a temperature adjustment to the growth rate calculation used to determine the end-of-cycle (EOC) distribution of indications of axial ODSCC at TSPs in support of the WBN Unit 2 OA to extend operation to September 2021.

To reduce the potential for additional ODSCC wear, WBN Unit 2 is currently operating at an approximate four degree Fahrenheit (4°F) reduction in primary system vessel outlet (T_{hot}) temperature during Cycle 4 operation as compared to Cycle 3. Reduction in T_{hot} is a controlled plant evolution and is evaluated to ensure that sufficient margins exist in the safety analyses to ensure safe operation at the T_{hot} reduction value.

WBN Unit 2 Technical Specification (TS) 5.7.2.12, "Steam Generator (SG) Program," and WBN Unit 2 TS 5.9.9, “Steam Generator Tube Inspection Report,” are based on NRC Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," which does not include an adjustment for reduced T_{hot} temperature differences from cycle to cycle operation at WBN Unit 2.

The temperature adjusted voltage growth rate calculation is shown in Section 10.5.6.1.6 of Electric Power Research Institute (EPRI) Report 1018047, Addendum 7 to NP-7480-L, “Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits: Addendum 7.” Implementation of the temperature adjusted voltage growth rates in a revised Watts Bar Unit 2 90-Day GL 95-05 OA, represents a departure from an element of an evaluation methodology as described in the UFSAR pursuant to 10 CFR 50.59(a)(2)(i). The use of the temperature adjusted voltage growth rate is considered to be a non-conservative change as margin is gained when calculating SG tube burst probability when the T_{hot} temperature is reduced during subsequent plant operation. Therefore, the use of the temperature adjusted growth rate in support of the WBN Unit 2 OA is an exception to GL 95-05 and requires NRC approval.

By applying the temperature adjusted voltage growth combined with the POD values in the referenced letter, TVA anticipates that the planned mid-cycle outage can be extended to September 2021 when electrical load demands are typically lower. The proposed temperature adjusted voltage growth method will only be used until the WBN Unit 2 SGs are replaced, which are planned for the WBN Unit 2 Cycle 4 refueling outage (U2R4) scheduled to commence in spring 2022. Following the WBN Unit 2 mid-cycle SG inspection, the application of the temperature adjusted voltage growth method, combined with the POD values in the referenced letter, will be reassessed to determine the allowed cycle duration.

Enclosure 1 to this submittal provides a description and technical evaluation of the proposed change, a regulatory evaluation, and a discussion of environmental considerations for the proposed change. Attachment 1 to Enclosure 1 to this submittal provides the existing WBN UFSAR pages marked up to show the proposed changes. Attachment 2 to Enclosure 1 to this submittal provides the existing WBN UFSAR pages retyped to show the proposed changes. There are no corresponding TS changes required to apply the temperature adjusted voltage growth method as the associated requirements are only discussed in GL 95-05, and because WBN Unit 2 TS 5.7.2.12 and TS 5.9.9 do not contain a description of the growth rate calculation methodology to be used.

In support of the technical evaluation in Enclosure 1, Enclosure 2 contains Westinghouse Electric Company LLC (Westinghouse) Letter Report, LTR-CDMP-21-4 P-Attachment, Revision 0, "Watts Bar U2R3 Steam Generator Alternate Repair Criteria Generic Letter 95-05 Temperature Adjustment Growth Rate Methodology for 90-Day Report."

Enclosure 2 contains information that Westinghouse considers to be proprietary in nature pursuant to 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (a)(4). Enclosure 3 contains a non-proprietary version of Enclosure 2. Enclosure 4 provides the Westinghouse Application for Withholding Proprietary Information from Public Disclosure CAW-21-5149 affidavit supporting this proprietary withholding request. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the NRC and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.390. Accordingly, TVA requests that the information, which is proprietary to Westinghouse, be withheld from public disclosure in accordance with 10 CFR Section 2.390. Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-21-5149 and should be addressed to Zachary S. Harper, Manager, Licensing Engineering, Westinghouse Electric Company, 1000 Westinghouse Drive, Suite 165, Cranberry Township, Pennsylvania 16066.

TVA has determined that there are no significant hazard considerations associated with the proposed change and that the change qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). In accordance with 10 CFR 50.91, "Notice for Public Comment; State Consultation," TVA is sending a copy of this letter and the enclosure to the Tennessee Department of Environment and Conservation.

In order to support planning for the WBN Unit 2 mid-cycle outage, TVA requests NRC approval of the proposed license amendment on an expedited basis by May 19, 2021, with implementation by May 28, 2021. The basis for the requested NRC approval date is that TVA is unable to secure enough contracted firm capacity with energy call rights for August necessary to stay above the North American Electric Reliability Corporation (NERC) Operating Reserve requirement considering an August 2021 mid-cycle outage. As currently scheduled in August 2021, TVA is obligated to report this outage to the Southeastern Electric Reliability Council (SERC) for inclusion in their summer reliability assessment as a bulk power system reliability threat. If approval is received by May 19, 2021, to extend the WBN Unit 2 mid-cycle outage to September 2021, TVA will submit an amendment to SERC stating the threat is removed prior to the start of the summer season.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Kimberly D. Hulvey, Senior Manager, Fleet Licensing, at (423) 751-3275.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 25th day of February 2021.

Respectfully,

James T. Polickoski
Director, Nuclear Regulatory Affairs

Enclosures:

1. Evaluation of Proposed Change
2. Westinghouse Letter Report, LTR-CDMP-21-4 P-Attachment, Revision 0 (Proprietary)
3. Westinghouse Letter Report, LTR-CDMP-21-4 NP-Attachment, Revision 0 (Non-Proprietary)
4. Westinghouse Electric Company LLC Application for Withholding Proprietary Information from Public Disclosure (Affidavit CAW-21-5149)

cc (Enclosures):

NRC Regional Administrator – Region II
NRC Project Manager – Watts Bar Nuclear Plant
NRC Senior Resident Inspector – Watts Bar Nuclear Plant
Director, Division of Radiological Health – Tennessee State Department of Environment and Conservation

Evaluation of Proposed Change

Subject: **Expedited Application for Approval to Use a Growth Rate Temperature Adjustment When Implementing the Generic Letter 95-05 Analysis for the Watts Bar Nuclear Plant (WBN), Unit 2 Steam Generators (WBN TS-391-21-002)**

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Attachments:
1. Proposed UFSAR Changes (Markups) for WBN Unit 2
2. Proposed UFSAR Changes (Final Typed) for WBN Unit 2

1.0 SUMMARY DESCRIPTION

In accordance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.90, “Application for amendment of license, construction permit, or early site permit,” Tennessee Valley Authority (TVA) is requesting a license amendment to Facility Operating License No. NPF-96 for the Watts Bar Nuclear Plant (WBN), Unit 2.

The proposed license amendment request (LAR) revises the WBN dual-unit Updated Final Safety Analysis Report (UFSAR) to apply a temperature adjustment to the growth rate calculation used to determine the end-of-cycle (EOC) distribution of indications of axial outside diameter stress corrosion cracking (ODSCC) at tube support plates (TSP) in support of the WBN Unit 2 operational assessment (OA).

WBN Unit 2 Technical Specification (TS) 5.7.2.12, "Steam Generator (SG) Program," and WBN Unit 2 TS 5.9.9, “Steam Generator Tube Inspection Report,” are based on Nuclear Regulatory Commission (NRC) Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," which does not include an adjustment for reduced primary system vessel outlet (T_{hot}) temperature differences from cycle to cycle operation at WBN Unit 2.

Implementation of the temperature adjusted voltage growth rates as shown in Section 10.5.6.1.6 of Electric Power Research Institute (EPRI) Report 1018047 (Reference 1), in a revised Watts Bar Unit 2 90-Day GL 95-05 OA, represents a departure from an element of an evaluation methodology as described in the UFSAR pursuant to 10 CFR 50.59(a)(2)(i). The use of the temperature adjusted voltage growth rate is considered to be a non-conservative change as margin is gained when calculating SG tube burst probability when the T_{hot} temperature is reduced during subsequent plant operation. Therefore, the use of the temperature adjusted growth rate in support of the WBN Unit 2 OA is an exception to GL 95-05 and requires NRC approval.

2.0 DETAILED DESCRIPTION

2.1 PROPOSED CHANGES

The “Unit 2 Only” section of the WBN dual-unit UFSAR Section 5.5.2.4, which refers to GL 95-05, is revised to add the following:

> *Also, when operating temperature differences exist from cycle-to-cycle, an exception to the GL 95-05 analysis in the form of a temperature adjustment to the growth rate calculation in accordance with Section 10.5.6.1.6 of Reference 27 will be applied. The temperature adjustment methodology will be used to determine the End of Cycle voltage distribution of axial indications for comparison to the conditional probability of tube burst of less than or equal to 1×10^{-2} and to determine the total primary-to-secondary leak rate from an affected SG during a postulated main steam line break event. This same temperature adjustment methodology will be used to modify the average growth rate used to determine the upper voltage repair limits. This exception applies until the Unit 2 Steam Generators are replaced([28]).*

Additionally, the Reference Section in UFSAR Section 5.5 will be revised to add new Reference 27 (EPRI Report 1018047) and new Reference 28 to reflect NRC approval of this LAR.

Attachment 1 to Enclosure 1 provides the existing WBN UFSAR pages marked up to show the proposed changes. Attachment 2 to Enclosure 1 provides the existing WBN UFSAR pages retyped to show the proposed changes. There are no corresponding TS changes required to apply the temperature adjusted voltage growth method as the associated requirements are only discussed in GL 95-05, and because WBN Unit 2 TS 5.7.2.12 and TS 5.9.9 do not contain a description of the growth rate calculation methodology to be used.

2.2 CONDITION INTENDED TO RESOLVE

In Reference 2, the Nuclear Regulatory Commission (NRC) approved a license amendment for WBN Unit 2 to revise the WBN dual-unit UFSAR Section 5.5.2.4 to apply an eddy current probability of detection (POD) of 0.9 to indications of axial ODSCC at TSPs with bobbin voltage amplitudes of greater than or equal to (≥) 3.2 volts, but less than (<) 6.0 volts and a POD of 0.95 to indications of ≥ 6.0 volts in the WBN Unit 2 steam generators (SG) for the beginning of cycle (BOC) voltage distribution in support of the WBN Unit 2 OA.

Based on the OA performed by TVA utilizing the above POD values, TVA is required to do a mid-cycle outage of WBN Unit 2 in August 2021 to perform an inspection of the WBN Unit 2 SGs. Performing a mid-cycle outage in August 2021 is not desirable due to high peak electrical load demands. By applying the temperature adjusted voltage growth combined with the POD values in Reference 2, TVA anticipates that the planned mid-cycle outage can be extended to September 2021 when electrical load demands are not as high.

3.0 TECHNICAL EVALUATION

3.1 SYSTEM DESCRIPTION

The WBN Unit 2 SGs have a vertical shell and U-tube evaporator with integral moisture separating equipment. The reactor coolant flows through the inverted U-tubes, entering and leaving through the nozzles located in the hemispherical bottom head of the SG. The head is divided into inlet and outlet chambers by a vertical partition plate extending from the head to the tubesheet. Steam is generated on the shell side and flows upward through the moisture separators to the outlet nozzle at the top of the vessel. The WBN Unit 2 SG have Alloy 600 mill annealed (Alloy 600MA) tube material. Details of the WBN Unit 2 SGs are described in the UFSAR Section 5.5.2, “Steam Generator.” Figure 5.5-3b of the WBN UFSAR shows the design of the WBN Unit 2 SGs. Materials of construction for the WBN Unit 2 SGs are provided in UFSAR Table 5.2-8, “Reactor Coolant Pressure Boundary Materials Class 1 Primary Components.” Materials are selected and fabricated in accordance with the requirements of ASME Code Section III.

As part of the RCPB, the SG tubes are unique, in that they act as a heat transfer surface between the primary and secondary systems to remove heat from the primary system. In addition, the SG tubes isolate the radioactive fission products in the primary coolant from the secondary system.

The SG tube rupture (SGTR) accident is the limiting design basis event for SG. The analysis of an SGTR event assumes a bounding primary to secondary leakage rate equal to the operational leakage rate TS limit, plus the leakage rate from a double-ended rupture of a single tube. The accident analysis for an SGTR assumes the contaminated secondary fluid is only briefly released to the atmosphere via safety valves. The analysis for design basis accidents and transients other than an SGTR assume the SG tubes retain their structural integrity (i.e., they are assumed not to rupture). In these analyses, the steam discharge to the atmosphere is based on the total primary to secondary leakage from all SGs or is assumed to increase to the TS limit because of accident-induced conditions. For accidents that do not involve fuel damage, the primary coolant activity level is assumed equal to the TS limits. For accidents that assume fuel damage, the primary coolant activity is a function of the amount of activity released from the damaged fuel.

SG tube integrity is necessary to ensure the tubes are capable of performing their intended safety functions. Concerns relating to the integrity of the tubing stem from the fact that the SG tubing is subject to a variety of degradation mechanisms. SG tubes have experienced tube degradation related to corrosion phenomena, such as wastage, pitting, intergranular attack, and stress corrosion cracking, along with other mechanically induced phenomena such as wear. These degradation mechanisms can impair tube integrity if they are not managed effectively. The SG performance criteria are used to manage SG tube degradation.

The industry, working through the EPRI Steam Generator Management Program (SGMP), has implemented a generic approach to managing SG performance referred to as "Steam Generator Degradation Specific Management" (SGDSM). The overall program is described in NEI 97-06, which is supported by EPRI guidelines, including:

- Pressurized Water Reactor (PWR) Steam Generator Examination Guidelines
- SG Integrity Assessment Guidelines
- SG In-Situ Pressure Test Guidelines
- PWR Primary-to-Secondary Leak Guidelines
- PWR Primary Water Chemistry Guidelines
- PWR Secondary Water Chemistry Guidelines

NEI 97-06 and the EPRI Guidelines define a comprehensive, performance-based approach to managing SG performance.

3.2 TECHNICAL ANALYSIS

Enclosure 2 contains Westinghouse Electric Company LLC (Westinghouse) Letter Report, LTR-CDMP-21-4 P-Attachment, Revision 0, “Watts Bar U2R3 Steam Generator Alternate Repair Criteria Generic Letter 95-05 Temperature Adjustment Growth Rate Methodology for 90-Day Report,” which is a technical evaluation performed by Westinghouse to determine the appropriateness of the temperature adjustment growth rate calculation for application specific to the WBN Unit 2 SGs. As noted in Reference 1, EPRI Report 1018047 is synonymous with Addendum 7 to the NP-7480-L database report.

Estimated Operating Interval Extension with Temperature Adjustment

WBN Unit 2 is currently operating at an approximate four degree Fahrenheit (4°F) reduction in T_{hot} during Cycle 4 operation as compared to Cycle 3. An adjustment factor of 0.91 is applied to the Cycle 3 growth to account for the 4°F reduction. Applying the temperature adjustment equation described in Enclosure 2 results in a preliminary operating interval extension of 27 calendar days to the time period calculated using the revised POD values (Reference 2). This operating interval extension is reduced if a T_{hot} reduction of less than 4°F is used. Therefore, the current T_{hot} may be modified to accommodate the actual operating interval between the OA for the revised POD values (i.e., an August mid-cycle outage) and the OA for the temperature adjusted voltage growth rates and the revised POD values (i.e., a September mid-cycle outage).

Conclusion

For some degradation types (e.g., primary water stress corrosion cracking and ODSCC at other locations in the tube bundle), as described in Section 5 of Reference 3, it is accepted practice in OA development that if RCS temperature changes, or if growth rate data from multiple plants with different temperatures are being combined, then the combined data should be normalized to a common temperature using the Arrhenius equation and the appropriate activation energy constant. By applying the temperature adjusted voltage growth rate adjustment combined with the POD values in Reference 2, TVA anticipates that the planned mid-cycle outage can be extended to September 2021 when electrical load demands are typically lower.

4.0 REGULATORY EVALUATION

4.1 APPLICABLE REGULATORY REQUIREMENTS AND CRITERIA

General Design Criteria

WBN Unit 2 was designed to meet the intent of the "Proposed General Design Criteria for Nuclear Power Plant Construction Permits" published in July 1967. The WBN construction permit was issued in January 1973. The UFSAR, however, addresses the GDC published as Appendix A to 10 CFR 50 in July 1971. Conformance with the GDCs is described in Section 3.1.2 of the UFSAR.

Each criterion listed below is followed by a discussion of the design features and procedures that meet the intent of the criteria. Any exception to the 1971 GDC resulting from the earlier commitments is identified in the discussion of the corresponding criterion.

> *Criterion 14-Reactor coolant pressure boundary.* The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, or rapidly propagating failure, and of gross rupture.

Compliance with GDC 14 is described in Section 3.1.2.2 of the WBN UFSAR.

Criterion 15-Reactor coolant system design. The reactor coolant system and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary are not exceeded during any condition of normal operation, including anticipated operational occurrences.

Compliance with GDC 15 is described in Section 3.1.2.2 of the WBN UFSAR.

Criterion 16-Containment design. Reactor containment and associated systems shall be provided to establish an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require.

Compliance with GDC 16 is described in Section 3.1.2.2 of the WBN UFSAR.

Criterion 30-Quality of reactor coolant pressure boundary. Components, which are part of the reactor coolant pressure boundary, shall be designed, fabricated, erected, and tested to the highest quality standards practical. Means shall be provided for detecting and, to the extent practical, identifying the location of the source of reactor coolant leakage.

Compliance with GDC 30 is described in Section 3.1.2.4 of the WBN UFSAR.

Criterion 31-Fracture prevention of reactor coolant pressure boundary. The reactor coolant pressure boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating, maintenance, testing, and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual, steady state and transient stresses, and (4) size of flaws.

Compliance with GDC 31 is described in Section 3.1.2.4 of the WBN UFSAR.

Criterion 32-Inspection of reactor coolant pressure boundary. Components, which are part of the reactor coolant pressure boundary, shall be designed to permit (1) periodic inspection and testing of important areas and features to assess their structural and leaktight integrity, and (2) an appropriate material surveillance program for the reactor pressure vessel.

Compliance with GDC 32 is described in Section 3.1.2.4 of the WBN UFSAR.

4.2 PRECEDENT

There is no specific precedent for the proposed temperature adjustment to the growth rate calculation included in the GL 95-05 analysis discussed in this LAR. The use of the Arrhenius equation is described in Section 5.0 of EPRI Report 3002007571, “Steam Generator Management Program (SGMP): Steam Generator Integrity Assessment Guidelines,” Revision 4 (Reference 3) and the temperature adjustment to the growth rate calculation methodology is described in Section 10.5.6.1.6 of Reference 1.

4.3 No Significant Hazards Consideration

Tennessee Valley Authority (TVA) proposes to revise the Watts Bar Nuclear Plant (WBN) dual-unit Updated Final Safety Analysis Report (UFSAR) to apply the temperature adjustment to the growth rate calculation as described in Section 10.5.6.1.6 of EPRI Report 1018047, Addendum 7 to NP-7480-L Database, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits: Addendum 7." WBN Unit 2 Technical Specification (TS) 5.7.2.12, "Steam Generator (SG) Program," and WBN Unit 2 TS 5.9.9, “Steam Generator Tube Inspection Report,” are based on Nuclear Regulatory Commission (NRC) Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," which currently does not include a temperature adjustment in the growth rate calculation. The use of the temperature adjusted voltage growth rate is needed to provide a longer interval to exceeding the tube burst criteria of 1×10^{-2}.

TVA has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of amendment,” as discussed below:

1. *Does the proposed amendment involve a significant increase in the probability or consequence of an accident previously evaluated?*

   Response: No

   The use of the proposed temperature adjustment to the growth rate does not result in a significant increase in the main steam line break (MSLB) tube burst probability because it will be utilized in concert with accepted methodology that predicts a conservative operational cycle in terms of calendar days in compliance with the GL 95-05 acceptance criteria for tube burst in the faulted SG of less than or equal to 1×10^{-2} and results in primary-to-secondary leakage within acceptable limits during a postulated MSLB event. The use of the proposed temperature adjustment to the growth rate also does not result in a significant increase in the consequence of any accidents involving an MSLB.

   Therefore, TVA concludes that this proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. *Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?*

   Response: No.

   The use of the proposed temperature adjustment to the growth rate calculation concerns the SG tubes and can only affect the steam generator tube rupture (SGTR) accident during a postulated MSLB event. Its use results in an end-of-cycle (EOC) distribution of indications that remains in compliance with the GL 95-05 acceptance criteria for conditional tube burst in the faulted SG of less than or equal to 1×10^{-2} and results in primary-to-secondary leakage within acceptable limits during a postulated MSLB event.

Therefore, TVA concludes that this proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. *Does the proposed amendment involve a significant reduction in a margin of safety?*

Response: No.

The use of the proposed temperature adjustment to the growth rate calculation for the WBN Unit 2 operational assessment does not involve a significant reduction in a margin of safety. The applicable margin of safety potentially impacted is the WBN Unit 2 TS 5.9.9 projected EOC conditional probability of burst. The use of the proposed temperature adjustment to the growth rate calculation does not result in a significant increase in the calculated MSLB tube burst probability because it will be utilized in concert with accepted methodology that predicts a conservative operational cycle in terms of calendar days in compliance with the GL 95-05 acceptance criteria for conditional tube burst in the faulted SG of less than or equal to 1×10^{-2} and results in primary-to-secondary leakage within acceptable limits during a postulated MSLB event.

Therefore, TVA concludes that this proposed change does not involve a significant reduction in a margin of safety.

Based on the above, TVA concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92 (c), and accordingly, a finding of “no significant hazards consideration” is justified.

4.4 CONCLUSION

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission’s regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released off site, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. EPRI Report 1018047, Addendum 7 to NP-7480-L Database, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits: Addendum 7," EPRI, Palo Alto, CA: 2008, September 2008 (ML082620215 and ML082620214)
2. NRC letter to TVA, “Watts Bar Nuclear Plant, Unit 2 - Issuance of Amendment No. 48 Regarding Use of Alternate Probability of Detection Values for Beginning of Cycle in Support of Operational Assessment (EPID L-2020-LLA-0273),” dated February 9, 2021 (ML21027A167)
3. EPRI Report 3002007571, Steam Generator Management Program (SGMP): Steam Generator Integrity Assessment Guidelines, Revision 4, June 2016 (ML16208A272)

Enclosure 1

Attachment 1

Proposed UFSAR Changes (Markups) for WBN Unit 2

Steam Generator Tubing voltage-based Alternate Repair Criteria (ARC) for Axial Outside Diameter Stress Corrosion Cracking (ODSCC) at tube support plate intersections was approved by NRC [23]. Implementation of ODSCC ARC using GL 95-05 [24] as guidance is in accordance with Technical Specification inservice examination requirements and Reference 25. As an alternative to the probability of detection of 0.6 required by GL 95-05, a probability of detection (POD) of 0.9 will be applied to indications of axial ODSCC at tube support plates with bobbin voltage amplitudes of greater than or equal to 3.2 volts, but less than 6.0 volts, and a POD of 0.95 will be applied to indications of axial ODSCC at tube support plates with bobbin voltage amplitudes of greater than or equal to 6.0 volts until the Unit 2 Steam Generators are replaced[26]. A POD of 0.6, in accordance with GL 95-05, will be used for indications less than 3.2 volts. Also, when operating temperature differences exist from cycle-to-cycle, an exception to the GL 95-05 analysis in the form of a temperature adjustment to the growth rate calculation in accordance with Section 10.5.6.1.6 of Reference 27 will be applied. The temperature adjustment methodology will be used to determine the End of Cycle voltage distribution of axial indications for comparison to the conditional probability of tube burst of less than or equal to 1×10^{-2} and to determine the total primary-to-secondary leak rate from an affected SG during a postulated main steam line break event. This same temperature adjustment methodology will be used to modify the average growth rate used to determine the upper voltage repair limits. This exception applies until the Unit 2 Steam Generators are replaced[28].

5.5.3 Reactor Coolant Piping

5.5.3.1 Design Bases

The RCS piping is designed and fabricated to accommodate the system pressures and temperatures attained under all expected modes of plant operation or anticipated system interactions. Stresses are maintained within the limits of Section III of the ASME Nuclear Power Plant Components Code. Code and material requirements are provided in Section 5.2.

Materials of construction are specified to minimize corrosion/erosion and ensure compatibility with the operating environment.

The piping in the RCS is Safety Class 1 and is designed and fabricated in accordance with ASME Section III, Class 1 requirements.

Stainless steel pipe conforms to ANSI B36.19 for sizes 1/2-inch through 12 inches and wall thickness Schedules 40S through 80S. Stainless steel pipe outside of the scope of ANSI B36.19 conforms to ANSI B36.10.

The minimum wall thicknesses of the loop pipe and fittings are not less than that calculated using the ASME III Class 1 formula of Paragraph NB-3641.1 (3), with an allowable stress value of 17,550 psi. The pipe wall thickness for the pressurizer surge line is Schedule 160. The minimum pipe bend radius is 5 nominal pipe diameters; ovalness does not exceed 6%.

Butt welds, branch connection nozzle welds, and boss welds are of a full-penetration design.

Processing and minimization of sensitization are discussed in Sections 5.2.3 and 5.2.5.

Flanges conform to ANSI B16.5.

Socket weld fittings and socket joints conform to ANSI B16.11.

23. NRC Safety Evaluation for Watts Bar Nuclear Plant Unit 2, Amendment 28, for Steam Generator Tubing Voltage Based Alternate Repair Criteria for Outside Diameter Stress Corrosion Cracking (ODSCC) dated June 3, 2019.

24. NRC Generic Letter 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," dated August 3, 1995.

25. TVA Letter to NRC "Application to Revise Watts Bar Nuclear Plant Unit 2 Technical Specifications for Use of voltage-based Alternate Repair Criteria in Accordance with Generic Letter 95-05 (391-WBN2-TS-17-30)" dated May 14, 2018 and as supplemented by letter CNL-18-128 dated November 8, 2018.

26. NRC letter to TVA, "WATTS BAR NUCLEAR PLANT, UNIT 2 - ISSUANCE OF AMENDMENT NO. 48 REGARDING USE OF ALTERNATE PROBABILITY OF DETECTION VALUES FOR BEGINNING OF CYCLE IN SUPPORT OF OPERATIONAL ASSESSMENT (EPID L-2020-LLA-0273)," dated February 9, 2021 (ML21027A167).

27. EPRI Report, 1018047, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits: Addendum 7," EPRI, Palo Alto, CA: 2008, September 2008.

28. NRC letter to TVA, "XXXXX," dated MM/DD/YY (MLXXXX).

Enclosure 1

Attachment 2

Proposed UFSAR Changes (Final Typed) for WBN Unit 2

Steam Generator Tubing voltage-based Alternate Repair Criteria (ARC) for Axial Outside Diameter Stress Corrosion Cracking (ODSCC) at tube support plate intersections was approved by NRC [(23)]. Implementation of ODSCC ARC using GL 95-05 [(24)] as guidance is in accordance with Technical Specification inservice examination requirements and Reference 25. As an alternative to the probability of detection of 0.6 required by GL 95-05, a probability of detection (POD) of 0.9 will be applied to indications of axial ODSCC at tube support plates with bobbin voltage amplitudes of greater than or equal to 3.2 volts, but less than 6.0 volts, and a POD of 0.95 will be applied to indications of axial ODSCC at tube support plates with bobbin voltage amplitudes of greater than or equal to 6.0 volts until the Unit 2 Steam Generators are replaced[(26)]. A POD of 0.6, in accordance with GL 95-05, will be used for indications less than 3.2 volts. Also, when operating temperature differences exist from cycle-to-cycle, an exception to the GL 95-05 analysis in the form of a temperature adjustment to the growth rate calculation in accordance with Section 10.5.6.1.6 of Reference 27 will be applied. The temperature adjustment methodology will be used to determine the End of Cycle voltage distribution of axial indications for comparison to the conditional probability of tube burst of less than or equal to 1×10^{-2} and to determine the total primary-to-secondary leak rate from an affected SG during a postulated main steam line break event. This same temperature adjustment methodology will be used to modify the average growth rate used to determine the upper voltage repair limits. This exception applies until the Unit 2 Steam Generators are replaced[(28)].

5.5.3 Reactor Coolant Piping

5.5.3.1 Design Bases

The RCS piping is designed and fabricated to accommodate the system pressures and temperatures attained under all expected modes of plant operation or anticipated system interactions. Stresses are maintained within the limits of Section III of the ASME Nuclear Power Plant Components Code. Code and material requirements are provided in Section 5.2.

Materials of construction are specified to minimize corrosion/erosion and ensure compatibility with the operating environment.

The piping in the RCS is Safety Class 1 and is designed and fabricated in accordance with ASME Section III, Class 1 requirements.

Stainless steel pipe conforms to ANSI B36.19 for sizes 1/2-inch through 12 inches and wall thickness Schedules 40S through 80S. Stainless steel pipe outside of the scope of ANSI B36.19 conforms to ANSI B36.10.

The minimum wall thicknesses of the loop pipe and fittings are not less than that calculated using the ASME III Class 1 formula of Paragraph NB-3641.1 (3), with an allowable stress value of 17,550 psi. The pipe wall thickness for the pressurizer surge line is Schedule 160. The minimum pipe bend radius is 5 nominal pipe diameters; ovalness does not exceed 6%.

Butt welds, branch connection nozzle welds, and boss welds are of a full-penetration design.

Processing and minimization of sensitization are discussed in Sections 5.2.3 and 5.2.5.

Flanges conform to ANSI B16.5.

Socket weld fittings and socket joints conform to ANSI B16.11.

23. NRC Safety Evaluation for Watts Bar Nuclear Plant Unit 2, Amendment 28, for Steam Generator Tubing Voltage Based Alternate Repair Criteria for Outside Diameter Stress Corrosion Cracking (ODSCC) dated June 3, 2019.

24. NRC Generic Letter 95-05, “Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking,” dated August 3, 1995.

25. TVA Letter to NRC “Application to Revise Watts Bar Nuclear Plant Unit 2 Technical Specifications for Use of voltage-based Alternate Repair Criteria in Accordance with Generic Letter 95-05 (391-WBN2-TS-17-30)” dated May 14, 2018 and as supplemented by letter CNL-18-128 dated November 8, 2018.

26. NRC letter to TVA, “WATTS BAR NUCLEAR PLANT, UNIT 2 - ISSUANCE OF AMENDMENT NO. 48 REGARDING USE OF ALTERNATE PROBABILITY OF DETECTION VALUES FOR BEGINNING OF CYCLE IN SUPPORT OF OPERATIONAL ASSESSMENT (EPID L-2020-LLA-0273),” dated February 9, 2021 (ML21027A167).

27. EPRI Report, 1018047, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits: Addendum 7," EPRI, Palo Alto, CA: 2008, September 2008.

28. NRC letter to TVA, “XXXXX,” dated MM/DD/YY (MLXXXX).

Enclosure 2

Westinghouse Letter Report, LTR-CDMP-21-4 P-Attachment, Revision 0 (Proprietary)

Enclosure 3

Westinghouse Letter Report, LTR-CDMP-21-4 NP-Attachment, Revision 0 (Non-Proprietary)

Westinghouse Electric Company

LTR-CDMP-21-4 NP-Attachment
Revision 0

Watts Bar U2R3 Steam Generator Alternate Repair Criteria Generic Letter 95-05 Temperature Adjustment Growth Rate Methodology for 90-Day Report

February 12, 2021

Author:
Levi Y. Marcus*
Component Design & Management Programs

Verifier:
Bradley T. Carpenter*
Component Design & Management Programs

Approved:
Michael E. Bradley*, Manager
Component Design & Management Programs

Watts Bar U2R3 Steam Generator Alternate Repair Criteria Generic Letter 95-05 Temperature Adjustment Growth Rate Methodology for 90-Day Report

Executive Summary

Based on the Operational Assessment (OA) performed by Tennessee Valley Authority (TVA) utilizing the recently revised probability of detection (POD) values (Reference 1), TVA anticipates having to do a mid-cycle outage in August 2021 to perform an inspection of the Watts Bar Nuclear Plant (WBN), Unit 2 steam generators (SGs). Performing a mid-cycle outage in August is not desirable due to higher peak electrical demand. Therefore, a further exception to the Generic Letter 95-05 Analysis to permit WBN, Unit 2 to utilize a temperature adjustment of voltage growth methods (T_{hot} growth), as described in Section 10.5.6.1.6 of Electric Power Research Institute (EPRI) Report 1018047, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits: Addendum 7," (Reference 2), is justified herein. By applying the T_{hot} growth rate combined with the POD values in the referenced letter, TVA anticipates that the planned mid-cycle outage can be conducted in September 2021 when electrical load demands are typically not as high.

The proposed revised temperature adjusted voltage growth rate calculation will only be used until the WBN, Unit 2 SGs are replaced, which are anticipated for the WBN, Unit 2 End-of-Cycle 4 (EOC-4) refueling outage scheduled for spring 2022 (U2R4).

Background and Purpose

Watts Bar Unit 2 Refueling Outage 3 (U2R3) was the first implementation of alternate repair criteria (ARC) in accordance with Generic Letter (GL) 95-05 at the unit. GL 95-05 provides guidance and criteria for the analysis of structural and leak integrity of steam generator (SG) tubes using bobbin detection of eddy current test (ECT) signals associated with axial outside diameter stress corrosion cracking (ODSCC) at tube support plate (TSP) intersections.

The method described in GL 95-05 uses the relationship of the measured eddy current bobbin probe voltage to burst pressure and leak rate to calculate the probability of burst (POB) and predicted leak rate (LR) for a population of flaws at TSP-to-tube intersections. The calculation is performed for each SG using Monte Carlo simulations for both condition monitoring (CM) and operational assessment (OA) cases. These evaluations were performed at U2R3 for WBN, Unit 2 and are documented in Reference 3.

The Generic Letter 95-05 OA must demonstrate structural and leakage integrity for each SG over the next planned operating cycle (defined as POB not exceeding $1x10^{-2}$ and predicted leakage below Technical Specification (TS) limits for the faulted SG during postulated main steam line break (SLB) accident conditions) (Reference 4). The primary OA inputs include the flaw voltage distribution at the beginning-of-Cycle 4, the flaw growth distribution based on the change in voltage measurements from U2R2 to U2R3, and the probability of detection of crack-like indications at TSP-to-tube intersections from bobbin probe. Per GL 95-05, "POD should be assumed to have a value of 0.6, or as an alternative, an NRC approved POD function can be used, if such a function becomes available." The default POD of 0.6 for all flaw voltages is conservative for higher voltage indications and does not allow for the demonstration of a reasonable duration Cycle 4 OA for SG3 at WBN, Unit 2.

An alternative POD was therefore developed for use in the U2R3 OA calculations. The alternative POD function has been developed specifically for WBN, Unit 2 based on the bobbin inspection technique utilized during U2R3 for detection of ODSCC at TSP intersections and the U2R3 SG3 noise measurements. The development methodology and other supporting technical bases for the alternate POD function are contained within Reference 5. As a result, an operating interval of approximately 285 calendar days is determined to remain in compliance with GL 95-05 Analysis Acceptance Criteria.

As noted above, the projected EOC-4a (where Cycle 4a refers to the operating interval from EOC-3 until the mid-cycle outage, U2R4a refers to the mid-cycle outage, and EOC-4a refers to the end of Cycle 4a) flaw voltage distribution is based on the change in voltage measurements between the inspections performed at WBN U2R2 and U2R3. In order to further extend the WBN, Unit 2 Cycle 4a operating interval, a second exception to the Generic Letter 95-05 Analysis methodology is justified below to account for the reduced temperature operation of WBN, Unit 2 during Cycle 4a. It is well understood that operating temperature is one of the factors that affects ODSCC growth, where lower temperatures produce less ODSCC growth. The temperature adjustment is applied to the projected WBN, Unit 2 Cycle 4a DSI voltage growth rate input taking credit for reduced temperature operation of WBN, Unit 2 during Cycle 4a operation. Section 10.5.6.1.6 of EPRI report NP-7480-L provides the specific form of the industry standard Arrhenius equation which will be used to make the temperature adjustment to the voltage growth rate. Use of the Arrhenius equation as an input which results in an extended period of operation is an exception to the GL 95-05 voltage growth rate calculation methodology described below used to determine the EOC voltage distribution in the OA and is justified herein.

Generic Letter 95-05 Growth Rate Calculation Methodology

As stated in Paragraph 2 b.2(2) of Reference 4,Voltage Growth Due to Defect Progression, potential voltage growth rates during the next inspection cycle (i.e., operating cycle between two scheduled SG inspections) should be based on voltage growth rates observed during the last one or two inspection cycles. For a given inspection, previous inspection results at tube-to-TSP intersections exhibiting a bobbin indication should be evaluated consistent with the data analysis guidelines in Section 3 of Reference 4 below. In cases in which data acquisition guidelines employed during previous inspections differ from those discussed in Section 3, the evaluation of the previous data should be adjusted to compensate for the difference. Voltage growth rates should only be evaluated for those intersections at which bobbin indications can be identified at two successive inspections, except if an indication changes from non-detectable to a relatively high voltage (e.g., 2.0 volts).

The distribution of voltage growth rates (based on the change in voltage on an intersection-to-intersection basis) should be determined for each of the last one or two inspection cycles. When only the current or the current and previous inspections employed data acquisition guidelines similar to those discussed in Section 3 of Reference 4, only the growth rate distribution for the previous cycle should be used to estimate the voltage growth rate distribution for the next inspection cycle. If the two previous inspections employed such similar guidelines, the most limiting of the two previous growth rate distributions should be used to estimate the voltage growth rate distribution for the next inspection cycle. However, the two distributions should be combined if one or both distributions is based on a minimal number (i.e., < 200) of indications. If the growth rate distribution, or combined distribution from two cycles, consists of fewer than 200 indications, a bounding probability distribution function of growth rates should be used based on consideration of experience to date at similarly designed and operated units. As described above, it is noted that the GL 95-05 analysis growth rate methodology licensed for application at WBN, Unit 2 does not include a provision for adjustment due to changes in temperature that may occur from cycle-to-cycle operation.

Temperature Dependent Growth Rate Discussion

For some degradation mechanisms, such as primary water and outer diameter-initiated stress corrosion cracking, growth rates are dependent on the reactor coolant system (RCS) temperature. In these cases, as described in Section 5 of Reference 6, it is accepted practice in OA development that if RCS temperature changes, or if growth rate data from multiple plants with different temperatures are being combined, then the combined data should be normalized to a common temperature using the Arrhenius Equation (1) and appropriate activation energy constants.

The Arrhenius equation is written in general terms as:

$$Rate = Ae^{-\Delta H/RT} \qquad (1)$$

where A is a constant, ΔH is the activation energy, R is the ideal gas constant and T is the absolute temperature. If the temperature from cycle-to-cycle increases, the growth rate increases; if the temperature decreases, the growth rate decreases. If ΔH is expressed in units of cal/mol then R is 1.985 cal/(mol K) and T is the absolute temperature in Kelvin.

Activation Energy Discussion

In the mid-to-late 1980s, the analysis of the results of destructive examinations of C-ring specimens (the C-ring is a constant-strain specimen with tensile stress produced on the exterior of the ring by tightening a bolt centered on the diameter of the ring) that had been exposed in various concentrations of NaOH over the temperature range of [

]^{a,c,e}. For ODSCC in Alloy 600 mill annealed (A600MA) tubes, a value of 30 kcal/mole for propagation is used (References 2, 6 and 7).

Temperature Adjustment for Voltage-Based Growth Rates at WBN, Unit 2

As described in Section 10.5.6.1.4 of Reference 2, the rate of growth of the indications, r, is considered to be a direct function of the applied stress, σ, raised to some power, n, on the order of 2 to 4.4 depending on the environment, and an Arrhenius relation function of the absolute temperature, T, of operation, i.e.,

$$r = A\sigma^n e^{-\frac{Q}{RT}} \qquad (2)$$

where Q is the activation energy of the material, 30 kcal/mole for A600MA, and R is the universal gas constant 1.986 cal/mol/°K or 1.103 cal/mol/°R (absolute zero is -459.67°F). As the temperature increases, the value of the exponent decreases and the inverse of the exponential and the rate of growth increases. Using the above expression, the time at temperature, t, taken as effective full power days (EFPD) or years, effective full power years (EFPY), can be converted from one operating temperature to another, i.e.,

$$t_2 = t_1 e^{\frac{Q}{R}\left(\frac{1}{T_2}-\frac{1}{T_1}\right)} \qquad (3)$$

where t_2 is the adjusted time of operation corresponding to temperature T_2, and t_1 is the time of operation at temperature T_1. For example, if T_2 is greater than T_1, the term in parentheses in Equation 3 is negative and the time of operation at T_2 for the same expected indication growth is shorter than at T_1.

This relationship is also expressed in Section 10.5.6.1.6 of Reference 2 with the growth of the indications as a linear function of the length of the operating cycle per the ODSCC ARC references.

$$\Delta V_2 = \Delta V_1 \frac{\Delta t_2}{\Delta t_1} e^{-\frac{Q}{R}\left(\frac{1}{T_2}-\frac{1}{T_1}\right)} \qquad (4)$$

where ΔV_2 is the growth during the cycle to be simulated and ΔV_1 is the growth during the cycle taken as a reference. The same identification is made for the EFPD of operation of the cycle being simulated, Δt_2, versus the EFPD for the reference cycle, Δt_1. The terms in the exponential follow those of Equation 3, i.e., activation energy, universal gas constant, and absolute temperatures of operation. Equation 4 results in a linear modifier for growth rates in the form of:

$$\frac{\Delta V_2}{\Delta t_2} = \frac{\Delta V_1}{\Delta t_1} e^{-\left(\frac{Q}{R}\right)\left(\frac{1}{T_2}-\frac{1}{T_1}\right)} \qquad (5)$$

Where $\frac{\Delta V_2}{\Delta t_2}$ is the DSI voltage growth rate for the cycle to be simulated, which in this case is the reduced temperature Cycle 4a, and $\frac{\Delta V_1}{\Delta t_1}$ is the DSI voltage growth rate for the reference cycle, in this case Cycle 3. As an example, a T_{hot} reduction of 4°F using the values for activation energy and the universal gas constant described above results in a linear multiplier of 0.910. This multiplier is applied to the Cycle 3 growth rates for use in the Cycle 4a EOC voltage projection. Figure 1 shows the reference Cycle 3 growth rate distribution for SG-3 (the limiting growth rate of all four SGs) compared to the temperature adjusted Cycle 4a growth rate distribution for SG3 when considering a T_{hot} reduction of 4°F.

Estimated Operating Interval Extension with Temperature Adjustment

WBN, Unit 2 is currently operating at a 4°F reduction in T_{hot} during Cycle 4 operation as compared to Cycle 3. Using the Arrhenius correlation discussed above, a correction factor of 0.91 is applied to the Cycle 3 growth to account for the lower hot leg temperature. This results in an overall shift of the growth distribution function that is supplied as input to the GL 95-05 operational assessment calculations. Figure 1 below displays the limiting voltage growth distribution for WBN, Unit 2 Cycle 3 which is exhibited by SG3 compared to the same voltage distribution when adjusted for the Cycle 4 T_{hot} reduction of 4 degrees. Since the growth adjustment derived from the Arrhenius correlation is applied as a linear correction factor to the indication growth distribution, the effect of the reduction is greater in the regions of larger growth. This can be seen in Figure 1 where the effect is greater at the tail of the growth curve. For example, at a cumulative distribution function (CDF) of 1.0, the Cycle 3 growth is 9.35V. This is reduced to 8.51V when applying the Arrhenius correction factor associated with a 4°F reduction in T_{hot} for Cycle 4a.

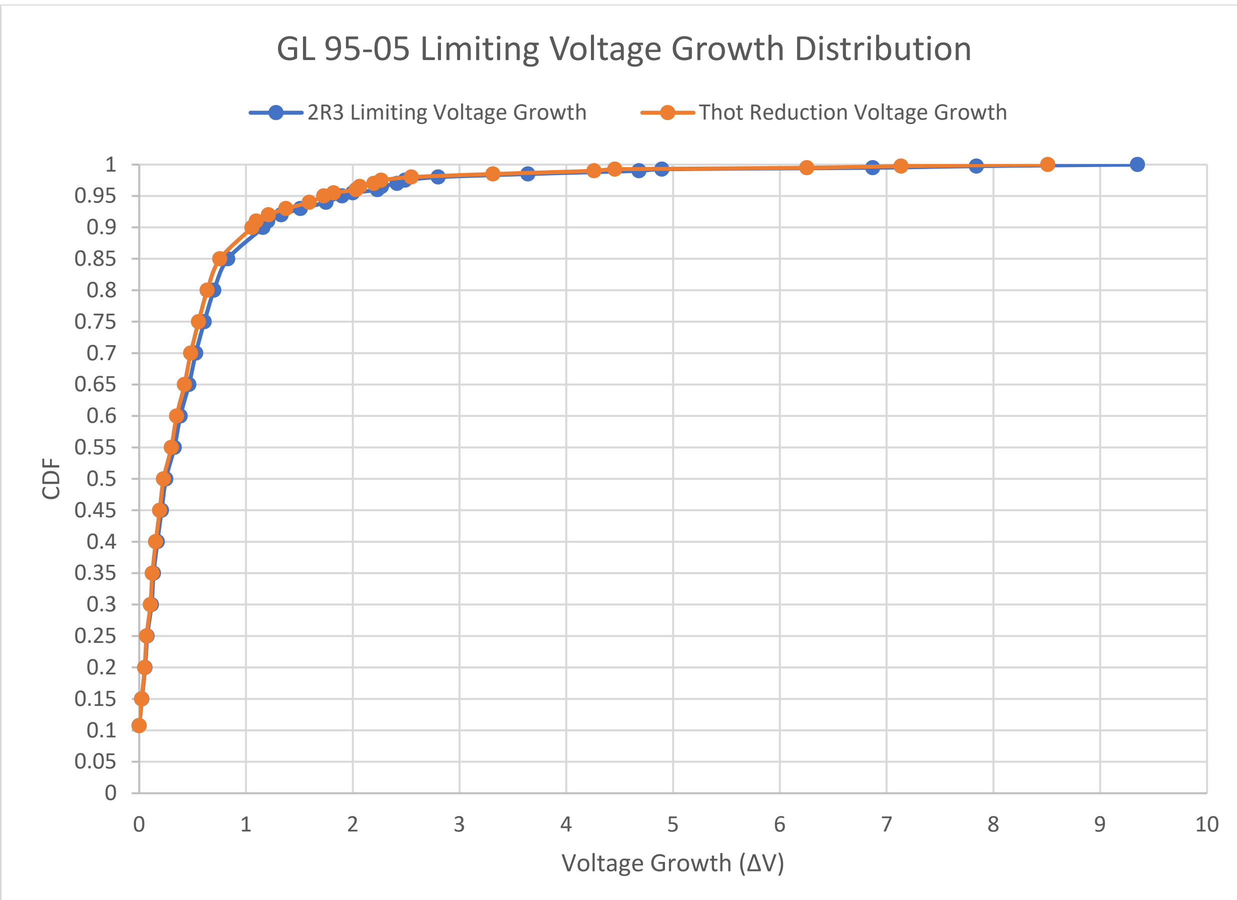

Figure 1: GL 95-05 Limiting Voltage Growth Distribution for WBN, Unit 2

Application of a temperature adjustment correction factor of 0.91, assuming a T_{hot} reduction of 4°F is maintained up to the mid-cycle inspection and the application of the alternate POD per Reference 1, results in a preliminary operating interval extension of approximately 27 days beyond the interval calculated without the 4°F T_{hot} adjustment. Changing T_{hot} at any point would affect the calculation of the temperature adjustment factor which would consequently affect the operating interval calculations.

Conclusion

It is acceptable to apply the Arrhenius equation as provided in Section 10.5.6.1.6 of Reference 2 for temperature adjustment of DSI voltage growth rates at WBN, Unit 2. By applying the T_{hot} growth rate adjustment combined with the POD values in the referenced letter, TVA anticipates that the planned mid-cycle outage can be extended to mid-September 2021 when load demands are not as high.

References

1. NRC letter to TVA, "Watts Bar Nuclear Plant, Unit 2 - Issuance of Amendment No. 48 Regarding Use of Alternate Probability of Detection Values for Beginning of Cycle in Support of Operational Assessment (EPID L-2020-LLA-0273)," dated February 9, 2021 (ML21027A167)
2. Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits: Addendum 7, EPRI, Palo Alto, CA; 2008. 1018047.
3. Westinghouse Letter SG-CDMP-21-1-NP, Revision 0, "Watts Bar Unit 2 Refueling Outage 3 Generic Letter 95-05 Voltage-Based Alternate Repair Criteria Final Report," February 2021.
4. NRC Generic Letter 95-05, Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking, August 3, 1995.
5. Westinghouse Letter No. LTR-CDMP-20-41 P-Attachment, Revision 0, "Watts Bar U2R3 Alternate Repair Criteria Generic Letter 95-05 Probability of Detection Methodology for 90-Day Report," December 2020.
6. Steam Generator Management Program: Steam Generator Integrity Assessment Guidelines: Revision 4. EPRI, Palo Alto, CA 2016. 3002007571,
7. Westinghouse Letter LTR-CDME-01-137, Revision 0, "Values of Activation Energy for PWSCC and ODSCC of MA Alloy 600," July 2001.

Enclosure 4

Westinghouse Electric Company LLC Application for Withholding Proprietary Information from Public Disclosure (Affidavit CAW-21-5149)

COMMONWEALTH OF PENNSYLVANIA:
COUNTY OF BUTLER:

(1) I, Zachary S. Harper, have been specifically delegated and authorized to apply for withholding and execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse).

(2) I am requesting the proprietary portions of LTR-CDMP-21-4 P-Attachment, Revision 0, "Watts Bar U2R3 Steam Generator Alternate Repair Criteria Generic Letter 95-05 Temperature Adjustment Growth Rate Methodology for 90-Day Report," be withheld from public disclosure under 10 CFR 2.390.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged, or as confidential commercial or financial information.

(4) Pursuant to 10 CFR 2.390, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse and is not customarily disclosed to the public.

(ii) The information sought to be withheld is being transmitted to the Commission in confidence and, to Westinghouse's knowledge, is not available in public sources.

(iii) Westinghouse notes that a showing of substantial harm is no longer an applicable criterion for analyzing whether a document should be withheld from public disclosure. Nevertheless, public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar technical evaluation justifications and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

(5) Westinghouse has policies in place to identify proprietary information. Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage (e.g., by optimization or improved marketability).

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

(6) The attached documents are bracketed and marked to indicate the bases for withholding. The justification for withholding is indicated in both versions by means of lower-case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower-case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (5)(a) through (f) of this Affidavit.

I declare that the averments of fact set forth in this Affidavit are true and correct to the best of my knowledge, information, and belief.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 2/12/2021

Zachary S. Harper, Manager
Licensing Engineering