TVA

Confidential Information Submitted Under 10 CFR 2.390

Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

August 1, 2008

TVA-WBN-TS-08-04 10 CFR 50.90

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

Gentlemen:

In the Matter of	)	Docket No. 50-390
Tennessee Valley Authority	)	

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - TECHNICAL SPECIFICATIONS CHANGE – "REVISION OF BORON REQUIREMENTS FOR COLD LEG ACCUMULATORS AND REFUELING WATER STORAGE TANK"

Pursuant to 10 CFR 50.90, Tennessee Valley Authority (TVA) requests a Technical Specifications (TS) change, WBN-TS-08-04, to License NPF-90 for WBN Unit 1. The proposed TS change will revise:

(1) Surveillance Requirement (SR) 3.5.1.4, Accumulators, and SR 3.5.4.3, Refueling Water Storage Tank, to specify three discrete levels of boron concentrations (Level 1, 2, or 3),
(2) TS 4.2.1, Fuel Assemblies, to increase the maximum number of Tritium Producing Burnable Absorber Rods (TPBARs) that can be irradiated per cycle from 400 to 2304,
(3) TS 5.9.5.a, Core Operating Limits Report (COLR), to indicate that the cycle specific boron concentrations (Level 1, 2, or 3) are specified in the COLR, and
(4) TS 5.9.5.b, COLR, to reference Westinghouse WCAP-16932-P, Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1.

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The proposed TS change revisions were revised in accordance with WCAP-16932-P to allow credit for the negative reactivity provided by the insertion of the rod cluster control assemblies (RCCAs) following a postulated cold leg loss of coolant accident (LOCA). Presently, the maximum number of TPBARs that can be inserted in the core is limited to 400 rods. Above 400 rods, post-LOCA subcriticality analyses indicate RCCA insertion is necessary to offset the reactivity penalty due to potential TPBAR failures and sump dilution at the time of hot leg switchover. Post-LOCA subcriticality only poses a potential concern for postulated cold leg breaks.

Enclosure 1 to this letter provides the description and technical evaluation of the proposed change. This includes TVA's determination that the proposed change does not involve a significant hazards consideration, and is exempt from environmental review. Annotated versions of the affected TS pages are provided in Enclosure 2. Annotated versions of the affected TS Bases pages and several sections of the UFSAR are given in Enclosure 3 and Enclosure 4, respectively, for information only.

Enclosure 5 contains two copies of Westinghouse proprietary document WCAP-16932-P, "Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1." It is supported by an affidavit signed by Westinghouse, the owner of the information. Enclosure 6 contains two copies of the non-proprietary version (WCAP-16932-NP). Enclosure 7 is Westinghouse authorization letter CAW-08-2434 with accompanying affidavit, Proprietary Information Notice, and Copyright Notice. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission, and addresses with specificity the considerations listed in 10 CFR 2.390(b)(4) of the Commission's regulations, and TVA hereby requests that the Westinghouse proprietary information be withheld from public disclosure in accordance with aforementioned regulation.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-08-2434 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company, LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and attachments to the Tennessee State Department of Public Health.

TVA requests approval of this TS change by July 2009 to support WBN Cycle 10 refueling outage and that implementation of the revised TS be within 90 days of NRC approval.

There are no regulatory commitments associated with this submittal.

If you have any questions about this change, please contact R. L. Clark at (423) 365-1818 or me at (423) 365-1824.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 1st day of August, 2008.

Sincerely,

M. K. Brandon

Enclosures:

1. TVA Evaluation Of Proposed Technical Specifications Change
2. Proposed Technical Specifications Change (Mark-Up)
3. Proposed Technical Specifications Bases Change (Mark-Up)
4. Proposed UFSAR Change (Mark-Up)
5. WCAP 16932 (proprietary)
6. WCAP 16932 (non-proprietary)
7. Westinghouse Affidavit

cc: See page 4

Enclosure
cc (Enclosures 1-4, 7):

NRC Resident Inspector
Watts Bar Nuclear Plant
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ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY (TVA)
WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
DOCKET NUMBER 390

TVA EVALUATION OF PROPOSED TECHNICAL SPECIFICATIONS CHANGE

TECHNICAL EVALUATION

1.0 SUMMARY DESCRIPTION

Pursuant to 10 CFR 50.90, Tennessee Valley Authority (TVA) is submitting a request for Technical Specifications (TS) change, WBN-TS-08-04, to License NPF-90 for WBN Unit 1. The proposed TS change will revise:

(1) Surveillance Requirement (SR) 3.5.1.4, Accumulators, and SR 3.5.4.3, Refueling Water Storage Tank, to specify three discrete levels of boron concentrations (Level 1, 2, or 3),
(2) TS 4.2.1, Fuel Assemblies, to increase the maximum number of Tritium Producing Burnable Absorber Rods (TPBARs) that can be irradiated per cycle from 400 to 2304,
(3) TS 5.9.5.a, Core Operating Limits Report (COLR), to indicate that the cycle specific boron concentrations (Level 1, 2, or 3) are specified in the COLR, and
(4) TS 5.9.5.b, COLR, to reference Westinghouse WCAP-16932-P, Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1.

The proposed TS change revisions were revised in accordance with WCAP-16932-P to allow credit for the negative reactivity provided by the insertion of the rod cluster control assemblies (RCCAs) following a postulated cold leg loss of coolant accident (LOCA). Presently, the maximum number of TPBARs that can be inserted in the core is limited to 400 rods with no credit for RCCA insertion. Above 400 rods, post-LOCA subcriticality analyses indicate RCCA insertion is necessary to offset the reactivity penalty due to potential TPBAR failures and sump dilution at the time of hot leg switchover. Post-LOCA subcriticality is a potential concern only for postulated cold leg breaks.

The proposed changes will allow the flexibility to adjust boron levels as necessary based on the specific requirements and design characteristics of the reload core such as, the number of TPBARs in the core, the cycle energy, boron worth, control rod worth, and global core reactivity. This change will minimize cost and reduce operational burden associated with the addition of large amounts of boron into the reactor coolant system until the cycle specific reload analysis requires the increased boron levels to support accident mitigation functions.

2.0 DETAILED DESCRIPTION

This amendment request will revise SRs 3.5.1.4, "Accumulators," and 3.5.4.3, "RWST," by specifying three discrete levels of boron concentration. Each level represents increasing minimum RWST and Accumulator boron concentrations depending on the number of TPBARs inserted in the core. The current requirement is based upon one discrete level i.e., for a

TPBAR range of 0 to 400 rods the required accumulator boron concentration range is 3000 to 3300 ppm. The proposed change will specify three discrete levels (Level 1, 2, and 3). Table 1 provides the proposed RWST and Cold Leg Accumulator (CLA) boron concentration range for each specified level. The number of TPBARs for each specified level is defined in Table 2 of this license amendment request.

Table 1
RWST and Accumulator Boron Levels

Level	Accumulator Minimum Boron Concentration (ppm)	Accumulator Maximum Boron Concentration (ppm)	RWST Minimum Boron Concentration (ppm)	RWST Maximum Boron Concentration (ppm)
1	2600	3800	2700	3800
2	3000	3800	3100	3800
3	3500	3800	3600	3800

Currently, Watts Bar uses the minimum boron concentrations corresponding to Level 2. The TS is further revised to indicate that the cycle specific discrete level is specified in the Core Operating Limits Report (COLR). The placing of the cycle specific discrete level in the COLR ensures that the cycle specific design requirements can be used for determining the amount of boron that is required.

In Enclosure 2, a change is also requested to TS Section 4.0, Design Features, to allow the insertion of a maximum of 2304 TPBARs into the reactor core for irradiation purposes. The specific number of TPBARS to be irradiated during a given cycle would be identified in the Reload Safety Evaluation but will, in all cases, be less than or equal to 2304.

In accordance with NRC Generic Letter 88-16, the licensees may remove cycle-dependent parameters from TS provided that the values of these parameters are included in the COLR and have been determined in accordance with NRC-approved methodology. TS Section 5.9.5.a has been revised to indicate that the cycle specific discrete levels for the RWST and CLA are specified in the COLR. The methodology used to generate these parameters is referenced in Section 5.9.5.b. The cycle specific boron concentration levels are relocated to the COLR to avoid frequent TS revisions to change the value of the operating limits which cannot be specified to reasonably bound several operating cycles without significant loss of operating flexibility.

In addition, supporting changes to each corresponding Bases pages are being made as indicated by the page mark-ups in Enclosure 3. Specifically, a statement on TS Bases page B 3.5-4 regarding no control rod credit is being removed since the Westinghouse methodology credits control rod insertion during a cold leg LOCA. A discussion of the parameters that affect the boron requirement is included in the Bases (page B 3.5-4 and B 3.5-26).

In summary, the boron requirements for the CLAs and the RWST are modified to establish a range of minimum RWST and CLA boron concentrations that will accommodate core designs with various TPBAR inventories.

3.0 TECHNICAL EVALUATION

3.1 Background

Department of Energy (DOE) and Tennessee Valley Authority (TVA) have agreed to cooperate in a program to produce tritium for the National Security Stockpile by irradiating Tritium Producing Burnable Absorber Rods (TPBARs) at Watts Bar Nuclear Plant (WBN).

TPBARs are similar to standard burnable poison rod assemblies (BPRAs) inserted into fuel assemblies. The BPRAs absorb excess neutrons, and help control the power in the reactor to ensure an even power distribution and extend the time between refueling outages. TPBARs functions in a matter similar to a BPRA, but TPBARs absorb neutrons using lithium aluminate instead of boron. Tritium is produced when the neutrons strike the lithium material. A solid zirconium material in the TPBAR (called a "getter") captures the tritium as it is produced. Most of the tritium is trapped in the getter material. However, a small fraction of the tritium will permeate through the TPBAR cladding into the reactor coolant system (see Section 3.2.3). After the TPBARs are removed from the core, and shipped to DOE extraction facility, the TPBARs are heated in a vacuum at high temperature to extract the tritium.

The environmental impacts of producing tritium at WBN were assessed in a Final Environmental Impact Statement (EIS) for the Production of Tritium in a Commercial Light Water Reactor (DOE/EIS - 0288, March 1999) prepared by DOE. TVA was a cooperating agency in the preparation of this EIS, and adopted the EIS in accordance with 40 CFR 1506.30 of the Council on Environmental Quality regulations. TVA's *Record of Decision* (ROD*) and Adoption of the Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* was published in the Federal Register at 65 Fed. Reg. 26259 (May 5, 2000). In addition to the DOE EIS and TVA's ROD, a Tritium Production Core (TPC) Topical Report (NDP-98-181, Rev. 1) was prepared by DOE to address the safety and licensing issues associated with incorporating TPBARs in a PWR. The Nuclear Regulatory Commission's (NRC) Standard Review Plan (SRP) (NUREG-0800) was used as the basis for evaluating the impact of the TPBARs on a reference plant. The NRC reviewed the TPC Topical Report and issued a Safety Evaluation Report (SER) (NUREG-1672) to support plant-specific licensing of TPBARs in a PWR.

The first TPBARs irradiated in WBN were in 4 lead test assemblies (LTAs), containing a total of 32 TPBARs during WBN Cycle 2. NRC approval of the LTAs was documented in WBN operating license Amendment 8 (ref. 1)

Amendment 40 (ref. 2) to the WBN operating license approved the irradiation of up to 2,304 TPBARs in WBN. The exact number of TPBARs to be irradiated would be identified in the safety evaluation performed by Westinghouse for each reload core and noted in the Core Operating Limits Report (COLR).

Based on issues related to the Reactor Coolant System (RCS) boron concentration, the TVA letter of August 18, 2003 revised the license amendment request dated May 30, 2003 and limited the number of TPBARs to be irradiated to 240 in WBN Cycle 6. This was approved with the issuance of Amendment 48 (ref. 3) to the WBN operating license. Based on issues related to tritium permeation observed in Cycle 6, TVA limited the number of TPBARs to be irradiated to 240 in cycles 7 and 8. Design changes made to the TPBARs scheduled for

Cycle 9 (current cycle) resulted in a request to increase the number of TPBARs to be irradiated to 400. This request was approved with the issuance of WBN operating license Amendment 67 (ref. 4). The actual number of TPBARs being irradiated in Cycle 9 is 368.

As described in this license amendment request, TVA is now requesting approval to revise the number of TPBARs that can be irradiated in any operating cycle to the original number (2,304) approved in Amendment 40. The number of TPBARs to be irradiated in any given operating cycle will be evaluated in the Westinghouse reload safety evaluation and documented in the COLR. The number will not exceed 2,304.

The following is a general discussion of how core parameters including TPBARs affect soluble boron worth and its effect on post-LOCA subcriticality margin. The general design requirements for the CLAs and RWST are also provided.

The soluble boron in the CLAs and RWST provides negative reactivity to maintain subcriticality following a LOCA. For a given core design, the boron concentration required to achieve subcriticality is a function of several variables, including global core reactivity and boron worth. The global core reactivity is determined by the cycle energy and the detailed core design. For example, the combination of a larger cycle energy and a smaller burnable absorber inventory would lead to a larger global core reactivity and, therefore, higher CLA and RWST minimum boron concentrations to ensure subcriticality.

The boron worth is dependent upon the total neutron absorption in the core, which is also determined by the detailed core design. When large amounts of neutron absorbers are used in the core design (as in the case with large numbers of TPBARs), there is competition for thermal neutrons among all the absorbers which result in hardening of the thermal neutron spectrum (shift towards higher neutron energy). As a consequence, the negative worth of each absorber, including reactor coolant system (RCS) boron worth, decreases. The positive reactivity insertion due to the cooldown from hot full power to cold conditions following a LOCA must be overcome by RCS boron. Because the RCS boron is now worth less, it takes a higher concentration to maintain subcriticality.

The minimum boron requirement for the CLA ensures that the reactor core will remain subcritical during the post-LOCA recirculation phase based upon the CLA's contribution to the post-LOCA sump mixture concentration. The functions and design of the CLAs are found in Section 6.3 of the WBN Updated Final Safety Analysis Report (UFSAR). The minimum boron requirement for the RWST ensures that sufficient negative reactivity is injected into the core to counteract any positive increase in reactivity caused by reactor coolant system cooldown. The RWST serves several purposes in addition to the injection of borated water during accident conditions. These functions are described in various sections of the UFSAR, including Sections 6.2, Containment Systems, 6.3, Emergency Core Cooling Systems, 9.1.3, Spent Fuel Pool Cooling and Cleanup System,15.2.4, Uncontrolled Boron Dilution, and 15.4.3, Steam Generator Tube Rupture.

The CLAs are required to be operable in Modes 1, 2 and 3 and the RWST in Modes 1, 2, 3, and 4. WBN Surveillance Requirements 3.5.1.4 and 3.5.4.3 associated with these functions also include requirements for borated water volume. The CLA specification has isolation valves and nitrogen cover-pressure requirements and the RWST specification includes requirements for temperature. These limitations support the ability of the CLAs and RWST to replace water to keep the core cooled and to ensure that sufficient boron is available to maintain the reactor in a subcritical condition during postulated accident conditions. The CLAs are passive devices that inject automatically when the reactor coolant system pressure drops below the accumulator's cover-pressure. The RWST provides borated water to the emergency core cooling system pumps for injection into the reactor. Three different sets of pumps are utilized to accommodate different size breaks in the reactor coolant system. The RWST also provides water to the containment spray system to control containment pressure during high energy line break accidents. When the injection of the RWST volume has been completed, the pumps switchover to the containment sump to continue the core cooling and containment pressure control functions.

3.2 Technical Analyses

Section 3.2.1 evaluates post-LOCA subcriticality for a range of RWST and CLA boron concentration that will accommodate core designs with various TPBAR inventories. This section takes credit for RCCA insertion with the most reactive RCCA stuck fully out of the core.

Section 3.2.2 provides justification for RCCA insertion following a cold leg LOCA (accumulator line break) based on the analyses provided by WCAP-16932-P.

Section 3.2.3 evaluates the projected tritium release rate from irradiated TPBARs which will be used to establish the number of TPBARs that can be irradiated in a given cycle to assure that the annual limit of 2,304 Ci is not exceeded. The projected tritium release rate is based on data obtained from Cycle 6, 7, and 8.

3.2.1 Post-LOCA Subcriticality Evaluation

The proposed change provides boron concentration requirements for the CLAs and RWST that correlate to cycle energy requirements, core reactivity, and the number of TPBARs in the core. Westinghouse has performed calculations within similar constraints as used for TS Amendment 48, including the additional potential of unborated water inleakage into containment as described in TVA's letter dated March 24, 2003 (ref. 5).

Currently for Cycle 9, the required minimum RWST and accumulator boron concentrations are 3100 ppm and 3000 ppm, respectively. These boron concentration levels were needed in Cycles 6 through 9 to demonstrate post-LOCA subcriticality for cold leg breaks assuming TPBAR failure and no RCCA insertion. Cycle 9 is licensed for 400 TPBARs and is currently irradiating 368 TPBARs. Cycles 6 through 8 employed 240 TPBARs. Future Watts Bar core designs, however, may employ up to 2304 TPBARs. In general, designs with larger TPBAR inventories will require larger minimum RWST and CLA boron concentrations to demonstrate post-LOCA subcriticality.

As stated previously, the post-LOCA subcriticality evaluations for Cycles 6 through 9 did not credit RCCA insertion. Analyses included with this license amendment request have demonstrated, however, that RCCA insertion is expected for cold leg breaks. With the assumption of RCCA insertion for cold leg breaks, post-LOCA subcriticality analyses have been performed using representative core models with four different TPBAR inventories: 0 TPBARs, 240 TPBARs, 928 TPBARs, and 2304 TPBARs. The discussion below presents these post-LOCA subcriticality assessments and demonstrates post-LOCA subcriticality for both hot leg and cold leg break scenarios for given RWST and CLA minimum boron concentrations. These minimum RWST and CLA boron concentration levels are defined in

Table 1. The maximum RWST and CLA boron concentrations are also indicated.

Four core designs were used in this evaluation. The first design is a contingency design developed for Watts Bar Cycle 6 (but not used). This design, which did not employ any TPBARs, is representative of future core designs without TPBARs. The second design is Watts Bar Cycle 6, which employed 240 TPBARs. This core design is representative of Tritium Production Core (TPC) designs with 1-240 TPBARs. The third and fourth designs are two equilibrium cycle TPC designs that were developed as part of the TPBAR program. The third design, referred to as the Nominal TPC Equilibrium Cycle design, uses 928 TPBARs and is representative of core designs employing 241-1000 TPBARs. The last design is referred to as the Maximum TPC Equilibrium Cycle Design. This design employs 2304 TPBARs and is representative of core designs with TPBAR inventories in the range of 1001-2304. These four models bound the range of anticipated TPBAR usage. Table 2 below summarizes these designs as well as the RWST and CLA boron concentration level assumed in the post-LOCA subcriticality evaluations.

Table 2
RWST and Accumulator Level Assumptions for Representative Core Designs

Case	Assumed RWST and Accumulator Boron Level	TPBARs	Representative Core Design
1	1	0	Cycle 6 Contingency Design
2	1	≤ 240	Cycle 6 TPC Design
3	2	>240 and ≤ 928	Nominal TPC Equilibrium Cycle Design
4	3	> 928 and ≤ 2304	Maximum TPC Equilibrium Cycle Design

Because of the potential for TPBAR failure, the post-LOCA subcriticality evaluation must consider two scenarios: (1) the hot leg break scenario, and (2) the cold leg break scenario.

The hot leg break scenario assumes the rupture of the nominal 14 inch pressurizer surge line. For this scenario, TPBAR failure is not expected to occur since maximum clad temperature for large hot leg breaks is typically very low for several reasons, including 1) stored energy is removed from the fuel since blow-down flow direction is consistent with that of normal cooling, 2) all accumulators inject, 3) no ECCS lines are faulted (i.e. no lines spill to containment). However, for this scenario control rods have not been shown to insert. Therefore, the post-LOCA subcriticality evaluation was performed assuming:

a) no TPBAR failures,
b) no xenon,
c) no control rod insertion,
d) a pre-condition of peak xenon to minimize the RCS boron concentration, and
e) most reactive time in life.

The cold leg break scenario assumes the rupture of the nominal 10 inch CLA injection line. For this scenario, TPBAR failure is conservatively assumed to occur. However, for this scenario control rod insertion is expected to occur. Therefore, the control rod worth can be used to offset the reactivity penalty of TPBAR leaching and pellet loss. In addition, the control rods can also be used to offset the penalty of sump boron dilution at the time of hot leg switchover.

The key assumptions for this scenario are:

a) a pre-condition of peak xenon to minimize the RCS boron concentration,
b) TPBAR failure for interior TPBARs with 50% Li-6 leaching and loss of 12 inches of $LiAlO_2$ pellets,
c) control rod insertion with the exception of a single worst stuck rod,
d) sump dilution at the time of hot leg switchover,
e) a conservative xenon credit at the time of hot leg switchover (3 hours), and
f) most reactive time in life.

Using the above assumptions, post-LOCA subcriticality was evaluated for the four representative core designs described above. The following tables summarize the results for the limiting time in life. Table 3 is for the cold leg break scenario while Table 4 is for the hot leg break scenario.

Table 3
Cold Leg Break Post-LOCA Subcriticalty Evaluation for Representative Watts Bar Unit 1 Core Designs

Case No.	Number of TPBARs	Minimum Accumulator Boron (ppm)	Minimum RWST Boron (ppm)	Post-LOCA Sump Boron (ppm)	Cold Critical Boron (ppm)	Subcriticality Margin (ppm)
1	0	2600	2700	1623	1189	434
2	240	2600	2700	1624	1254	370
3	928	3000	3100	1747	1401	346
4	2304	3500	3600	1917	1715	202

Table 4
Hot Leg Break Post-LOCA Subcriticalty Evaluation for Representative Watts Bar Unit 1 Core Designs

Case No.	Number of TPBARs	Minimum Accumulator Boron (ppm)	Minimum RWST Boron (ppm)	Post-LOCA Sump Boron (ppm)	Cold Critical Boron (ppm)	Subcriticality Margin (ppm)
1	0	2600	2700	1920	1908	12
2	240	2600	2700	1923	1909	14
3	928	3000	3100	2078	2055	23
4	2304	3500	3600	2259	2114	145

As these tables show, subcriticality margin is available for all four cases. The hot leg break scenario, in which control rods are not credited, is clearly the limiting case.

Since core reactivity is load pattern dependent, post-LOCA subcriticality results can vary from cycle to cycle. As such, the subcriticality margins indicated by these tables should be considered representative values. Post-LOCA subcriticality is confirmed each cycle as a normal part of the reload safety evaluation process. For future Watts Bar core designs, the RWST/CLA minimum boron level required for subcriticality will be specified in the Core Operating Limits Report (COLR) as Level 1, 2, or 3 corresponding to the RWST and CLA boron concentrations given in Table 1. The minimum boron concentrations corresponding to the appropriate Level given in the COLR will be assumed in the post-LOCA subcriticality evaluations for the cycle-specific Reload Safety Evaluation.

The proposed boron concentration values ensure that the post-LOCA accident sump boron concentration is sufficient to prevent core re-criticality for a hot leg break or cold leg break. To support this proposed change, credit for the negative reactivity provided by insertion of the RCCA following a cold leg LOCA is needed. As shown above, this proposed change results in cold leg breaks being less limiting than the hot leg breaks. To change the current basis to now allow for RCCA insertion following a cold leg LOCA, a modification to the existing methodology is required.

3.2.2 <u>RCCA Insertion Following a Limiting Large Break Cold Leg LOCA</u>

The WBN Unit 1 Updated Final Safety Analysis Report (UFSAR) Section 3.6B.1, states that the dynamic effects of postulated double-ended pipe ruptures in the reactor coolant loop piping have been eliminated from the design bases for WBN Unit 1 by the application of the leak-before-break (LBB) technology in accordance with the final rule change to General Design Criterion 4 (GDC-4) of Appendix A to 10 CFR Part 50. As a consequence, WBN Unit 1 need not postulate a pipe rupture in the primary loops because a postulated leak would be detected by the leak detection system and the plant shutdown in accordance with Technical Specifications 3.4.13, RCS Operational Leakage, before catastrophic pipe failure occurs.

However, as stipulated in the final rule change to GDC-4, a non-mechanistic double-ended rupture of the largest pipe in the reactor coolant system (RCS) is still postulated for the purposes of sizing the containment, emergency core cooling systems, and environmental equipment qualification.

In addition, the provisions of 10 CFR 50, Appendix K, I.A.2, Fission Heat, allow control rods to be credited if their insertion is calculated to occur. With WBN Unit 1 primary loop qualified under the LBB program, control rod insertion capability need only be evaluated for large break LOCAs due to failure of non-qualified LBB piping such as the piping in the RCS auxiliary branch lines. The major pipes in the RCS auxiliary branch lines are the cold leg accumulator (CLA) injection lines, pressurizer surge line and the residual heat removal inlet lines. Analysis performed by Westinghouse on the RCS auxiliary branch lines has determined that the limiting cold leg LOCA is a rupture of the nominal 10 inch CLA injection line, and the limiting hot leg LOCA is a rupture of the nominal 14 inch pressurizer surge line.

Analyses demonstrating that control rods can be inserted following a cold leg LOCA are documented in WCAP-16932-P. These analyses address reactor vessel component structural distortion due to LOCA blow down loads coincident with a seismic event. Plant-specific seismic response spectra and design parameters that bound plant-specific information were used. Based on detailed analyses in WCAP-16932-P, the following key conclusions result:

1. The RCCA upper internals guide tube calculated loads for combined LOCA and seismic are less than the design allowable limits, as established by testing, such that control rod insertion will not be precluded for a cold leg LOCA.

2. No fuel assembly grid deformation is predicted based on calculated loads and measured allowables, such that control rod insertion will not be inhibited for the limiting leak-before break criteria cold leg break locations.

3. The upper internals assembly motion relative to the reactor vessel associated with the design bases LOCA (hot or cold leg) and the associated bounding cooldown displacement provide a time window for control rod insertion in excess of 5 minutes.

4. The combined seismic and LOCA loads for Watts Bar Unit 1 CRDM Seismic Support Platform Assembly are within the allowable limits and have sufficient margin so that the platform assembly provides the intended lateral restraint to the CRDM rod travel housings.

Based on the above conclusions it is acceptable to credit the negative reactivity associated with the insertion of the control rods following a large break cold leg LOCA for Watts Bar Unit 1. Consequently, the resulting negative reactivity credit can be applied in evaluating potential re-criticality in a post-LOCA scenario. This being the case, the hot leg LOCA is the limiting case. Therefore, the proposed boron concentrations are adequate for Watts Bar to demonstrate compliance with the long-term cooling requirements of 10 CFR 50.46.

In summary, this change allows operational flexibility with respect to the amount of boron that must be available and maintained to satisfy the safety function of the CLAs and RWST. Implementation of the proposed TS change will maintain the necessary boron concentration to mitigate the consequences of an accident and will continue to minimize the risk to the health and safety of the public.

3.2.3 TPBAR Tritium Release Rate

Design changes to reduce TPBAR tritium permeation was submitted to the NRC, as Technical Specification Change 07-01 and was approved by the NRC in Amendment No. 67. The modified TPBARs were installed in the reactor core during Cycle 9 that began March 2008. Technical Specification Change 07-01 confirmed that TVA would continue to apply the TPBAR performance metric of 2,304 Ci/year for tritium leakage into the RCS as established in WBN License Amendment No. 40. As noted below, the releases from Cycle 6, Cycle 7, and Cycle 8 on a calendar year basis were well below this limit.

Calculations indicated that the actual Cycle 6 TPBAR tritium release was 576 ± 240 Ci/year. Taking the upper bound on the uncertainty, the TPBAR tritium release was 816 Ci/year. The actual tritium release from Cycle 7 TPBARs was calculated to be 648 ± 240 Ci/year or an upper bound of 888 Ci/year. The actual tritium release from Cycle 8 TPBARs was calculated to be 696 ± 240 Ci/year or an upper bound of 936 Ci/year. The difference in the results is within the statistical uncertainty associated with the measurements. With these releases and 240 TPBARs in each cycle, the tritium release on a calendar year basis for Cycle 6, Cycle 7, and Cycle 8 continued to be well below regulatory limits and the limit of 2,304 Ci/year attributable to TPBARs. The tritium permeation from TPBARs in Cycle 8 closely tracked that of Cycle 7 (Figure 1).

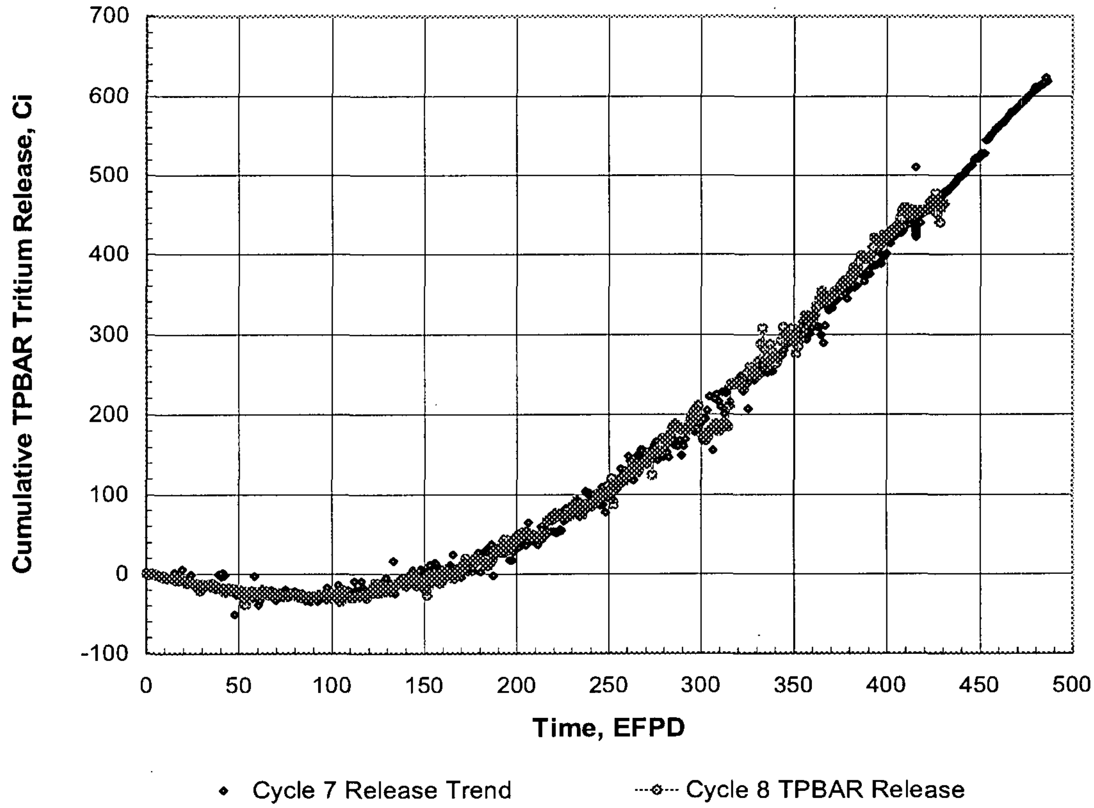

Figure 1

Cumulative TPBAR Tritium Release to RCS in Cycles 7 and 8 as a function of time in effective Full Power Days

TPBAR performance over the past three cycles (Cycle 6, Cycle 7, and Cycle 8) has demonstrated that increasing the number of TPBARs in the core can be accommodated without exceeding the tritium limit of 2,304 Ci/year attributable to TPBARs. These increases can be accomplished even if the design changes addressed in Technical Specification Change 07-01 are not effective and the tritium permeation from future Cycle TPBARs is at the same level as from Cycles 6, 7, and 8. However, it is expected that the permeation performance will be improved by the changes that have been incorporated in the Cycle 9 TPBAR design. The effectiveness of the changes will be determined through the monitoring of RCS tritium levels throughout future fuel cycle operation. The proposed amendment will increase the limit on the number of TPBARs that can be irradiated in the WBN core from 400 to 2,304, which is bounded by the analyses supporting the 2,304 limit imposed with Amendment Number 40.

As a normal part of the reload safety evaluation process TVA will calculate the expected tritium release from the TPBARs to establish the number of TPBARs to be irradiated in a given cycle to assure that the annual limit of 2,304 Ci/yr is not exceeded.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

The proposed amendment requests changes to the CLA and RWST boron concentration requirements by specifying three discrete levels of boron concentrations (Level 1, 2, or 3) representing increasing minimum RWST and Accumulator boron concentrations. The CLA and RWST functions are described in UFSAR Sections 6.2, 6.3, 9.1, 15.2.4 and 15.4.3, respectively. For these sections, the principal review performed by NRC is documented in the Safety Evaluation Report (SER), NUREG-0847, dated June 1982. The assessment of these functions is documented in the following sections of the SER:

6.2.2 "Containment Heat Removal Systems"

6.3 "Emergency Core Cooling System"

9.1 "Fuel Storage Facility"

15.2.4 "Reactivity and Power Distribution Anomalies"

15.4 "Radiological Consequences of Accidents"

Subsequent to the above review, by application dated August 20, 2001, TVA requested a license amendment to revise the WBN TS to address the irradiation of TPBARs for the DOE. Part of that amendment requested that both the CLA and RWST boron concentrations be raised to accommodate the irradiation of a maximum of 2304 TPBARs during a single cycle. NRC approved and issued a Safety Evaluation (SE) for Amendment 40 on September 23, 2002. NRC's review of the boron concentration changes is documented in SE Section 3.2, "Evaluation of Technical Specification Changes."

The change proposed by this amendment has been calculated by Westinghouse using a similar methodology as was used during the initial plant licensing and subsequent tritium amendment's proposed changes to determine CLA and RWST boron concentrations. The TS surveillance requirement is proposed to be changed to indicate that the COLR is the location where plant operators can determine the boron concentration level requirement for a given cycle. This allows the operators to verify, upon startup prior to entry into a mode where the RWST and the CLA are required to be operable, that the acceptance criteria for each surveillance requirement for boron concentrations are met. The proposed change continues to ensure sufficient boron concentrations to prevent a re-criticality event during postulated accidents and will not adversely affect compliance with the requirements for emergency core cooling systems in 10 CFR 50.46 or Appendix K of 10 CFR 50.

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.

4.2 No Significant Hazards Consideration

The proposed TS change will revise Watts Bar Nuclear Plant (WBN) Unit 1 Technical Specification (TS) Surveillance Requirements (SRs) 3.5.1.4, "Accumulators," and 3.5.4.3, "Refueling Water Storage Tank (RWST)," by specifying three discrete levels of boron concentrations (Levels 1, 2, or 3) representing increasing minimum RWST and Accumulator boron concentrations. This proposed change will allow the flexibility to adjust minimum boron levels as necessary based on the specific characteristics of core design (e.g., the number of TPBARs in the core, cycle energy requirements, the core reactivity, etc.). The TS is also revised to allow the insertion of a maximum of 2304 TPBARs into the reactor core for irradiation purposes. The TS is further revised to indicate that the cycle specific discrete level is specified in the COLR. The TS is also revised, in accordance to Generic Letter 88-16, by identifying the relocated parameters and the methodology used to generate the parameter values in TS Section 5.9.5. The placing of the cycle specific discrete level in the COLR ensures that the cycle specific design requirement can be used for determining the amount of boron that is required. In addition, supporting changes to each corresponding bases pages are being made.

TVA has evaluated whether or not a significant hazards consideration is involved with the proposed amendments 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 consequences of an accident previously evaluated?

   a. Boron Concentration

   Response: No.

   The proposed change modifies the required boron concentration for the Cold Leg Accumulators (CLAs) and RWST. The proposed values have been verified to maintain the required accident mitigation safety function for the CLAs and RWST. The CLAs and RWST safety function is to mitigate accidents that require the injection of borated water to cool the core and to control reactivity. These functions are not potential sources for accident generation and the modification of the boron concentration that supports event mitigation will not increase the potential for an accident. Therefore, the possibility of an accident is not increased by the proposed changes. The minimum boron levels are based on the specific requirements of the core design. For each reload core design, the boron level required for subcriticality will be specified. Since the boron levels will continue to maintain the safety function of the CLAs and RWST in the same manner as currently approved, the consequences of an accident are not increased by the proposed changes.

   The increase in the number of TPBARs does not adversely affect reactor neutronics or thermal-hydraulic performance; therefore, they do not significantly increase the probability of accidents or equipment malfunctions while in the reactor. The neutronic behavior of the TPBARs mimics that of standard burnable absorbers with only slight differences which are accommodated in the core design. The reload safety analysis performed for Watts Bar Unit 1 prior to each refueling cycle will confirm that any minor effects due to TPBARs on the reload core will be within fuel design limits. Analysis has shown that TPBARS are not expected to fail during Condition I through III events. TPBARs may fail during a large break LOCA or as a result of fuel handling accident. However, the radiological consequences of these events are within 10 CFR 100 limits.

b. RCCA Insertion

WBN Unit 1 proposes to credit RCCA insertion of negative reactivity for criticality control during the core cooling flow path realignment from cold leg recirculation to hot leg recirculation following the postulated cold leg LOCA. No physical modifications will be made to plant systems, structures, or components.

Credit for RCCA insertion is only being applied to demonstrate core subcriticality upon hot leg switchover (HLSO) following a cold leg LOCA. The performance criteria codified in 10 CFR 50.46 continues to be met. The ability of the RCCAs to insert under cold leg LOCA and seismic conditions is based on analysis given in WCAP-16932-P performed by Westinghouse. These analyses address reactor vessel component structural distortion in a LOCA environment coincident with a seismic event. The results indicated that RCCA guide tube deflection, fuel assembly grid distortion, and displacement of the control rod driveline and CRDM supports will not preclude RCCA insertion following a cold leg LOCA.

No physical modifications will be made to plant systems, structures, or components in order to implement the proposed methodology change. The safety functions of the safety related systems and components, which are related to accident mitigation, have not been altered. Therefore, the reliability of RCCA insertion is not affected. As such, taking credit for RCCA insertion does not alter the probability of an cold leg LOCA (the design basis accident at issue). The Westinghouse analyses provided in Enclosure 5 and 6 of the application demonstrate that RCCA insertion will occur, with substantial margin, following a design basis cold leg LOCA combined with a seismic event. Crediting RCCA insertion does not affect mechanisms for a malfunction that could impact the HLSO subcriticality analysis, or mechanisms that could initiate a LOCA. Taking credit for the negative reactivity available from insertion of the RCCAs, which is currently assumed for various accident analyses within the WBN Unit 1 licensing basis (e.g., small break LOCA, main steamline break, feedline break, steam generator tube rupture), does not affect equipment malfunction probability directly or indirectly. Therefore, crediting the RCCAs as a source of negative reactivity for post-LOCA criticality control at the time of HLSO does not significantly increase the probability of an accident previously evaluated.

Furthermore, the traditional conservative assumption that the most reactive RCCA is stuck fully out of the core is being maintained. A malfunction that results in one RCCA to fail to insert is a credible scenario, and is being considered for the post-LOCA subcriticality analysis following a cold leg LOCA. There will be sufficient negative reactivity, even with the most reactive RCCA stuck fully out of the core, to assure core subcriticality post-LOCA, as supported by the subcriticality analysis that is confirmed each and every fuel cycle as part of the reload documentation (i.e., the Reload Safety Evaluations). The core is shown to remain subcritical during the post-LOCA long-term cooling period, specifically while HLSO is performed. Thus, no additional radiological source terms are generated and the consequences of an accident previously evaluated in the UFSAR will not be significantly increased.

Therefore, the 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.

a. Boron Concentration

The proposed change of boron concentrations for the CLAs and RWST does not have a potential to generate accidents as they only serve to perform mitigation functions associated with an accident. The proposed requirements will maintain the mitigation function in an identical manner as currently approved. There is no plant equipment or operational changes associated with the proposed revision other than the adjustment of the boron level in the CLAs and RWST.

The TPBARS have been designed to be compatible with existing Westinghouse 17 x 17 fuel assemblies and conventional Burnable Poison Rod Assembly (BPRA) handling tools, equipment, and procedures, and therefore, no new accidents or equipment malfunctions are created by the handling of TPBARS.

Therefore, since the CLA and RWST functions are not altered and the plant will continue to operate with compatible components, the possibility of a new or different kind of an accident is not created.

b. RCCA Insertion

The proposed change involves crediting the negative reactivity that is available from the RCCAs for an analysis applicable several hours after the initiation of a cold leg LOCA. As such, this change involves post-LOCA recovery actions several hours after the break has occurred and, therefore, does not involve accident initiation. As discussed above, Westinghouse analyses demonstrated that the RCCAs will insert following a cold leg LOCA with seismic loadings. Thus, the safety functions of safety related systems and components have not been altered by this change. Crediting the negative reactivity that is available from the RCCAs for the post-LOCA subcriticality analysis upon HLSO does not cause the initiation of any accident, nor does the proposed activity create any new credible limiting single failure. Crediting the insertion of RCCAs does not result in any event previously deemed incredible being made credible nor is there any introduction of any new failure mechanisms that are not currently considered in the design basis LOCA. There are no changes introduced by this amendment concerning how safety related equipment is designed to operate under normal or design basis accident conditions since the calculations supporting RCCA insertion following a cold leg LOCA have assumed design basis break sizes in conjunction with seismic loadings.

Therefore, the possibility of an accident of a different type than already evaluated in the UFSAR is not created.

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

   Response: No.

   a. Boron Concentration

   This change proposes boron concentration requirements that support the accident mitigation functions of the CLAs and RWST equivalent to the currently approved limits. The proposed change does not alter any plant equipment or components and does not alter any setpoints utilized for the actuation of accident mitigation system or control functions. The proposed boron values have been verified to provide an adequate level of reactivity control for accident mitigation.

   TPBARs have been designed to be compatible with existing fuel assemblies, TPBARs do not adversely affect reactor neutronic or thermal-hydraulic performance. Analysis indicates that reactor core behavior and offsite doses remain relatively unchanged.

   b. RCCA Insertion

   Presently, no credit is taken for RCCA insertion in the analysis to demonstrate post-cold leg LOCA subcriticality at the time of HLSO. The current subcriticality analysis for this scenario relies only on the boron provided by the RWST and the accumulators. Thus, RCCA insertion provides another source of negative reactivity (margin of safety). Revising the post-LOCA subcriticality analysis to credit the negative reactivity associated with the RCCAs is a means to offset the reactivity penalty due to potential TPBAR failures and sump dilution at the time of hot leg switchover. The incorporation of this "defense-in-depth" source of negative reactivity in the HLSO subcriticality analysis has been conservatively determined to not cause a reduction in the margin of safety. 10 CFR 50, Appendix K, I.A.2., states, in part, that "[r]od trip and insertion may be assumed if they are calculated to occur," and provides for crediting RCCA insertion as an acceptable feature of emergency core cooling system (ECCS) evaluation models. The proposed change is based upon an analysis for WBN Unit 1 that demonstrates that the control rods will indeed insert and the resulting negative reactivity can be credited for post-LOCA criticality control.

   The proposed change would ensure that post-LOCA subcriticality is maintained during HLSO. Subsequently, there would not be a challenge to long-term core cooling due to a return to a critical condition. This being the case, the requirements of 10 CFR 50,46(b)(5) that, "...the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time.. ." continues to be satisfied and the margin of safety in the WBN licensing basis is preserved.

   Therefore, the 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.

Conclusions

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, based on the Environmental Impact Statement (EIS) prepared by the DOE (ref. 6), 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 offsite, 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. NRC letter to TVA dated September 15, 1997, "Issuance of Amendment on Tritium Producing Burnable Absorber Rod Lead Test Assemblies (TAC NO. M98615)"

2. NRC letter to TVA dated September 23, 2002, "Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment to Irradiate Up to 2304 Tritium-Producing Burnable Absorber Rods in the Reactor Core (TAC NO. MB1884)"

3. NRC letter to TVA dated October 8, 2003, "Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment Regarding Revision of Boron Requirements for Cold Leg Accumulators and Refueling Water Storage Tank (TAC NO. MB9480)"

4. NRC letter to TVA dated January 18, 2008, "Watts Bar Nuclear Plant, Unit 1 – Issuance of Amendment Regarding the Maximum Number of Tritium Producing Burnable Assembly Rods in the Reactor Core (TAC NO. MD5430)"

5. TVA's letter to NRC dated March 24, 2003, "Watts Bar Nuclear Plant, Unit 1 – Proposed License Amendment Request Change No. WBN-TS-03-06 – Updated Final Safety Analysis Report (UFSAR) Failure Modes and Effects Analysis (FEMA) – Use of Operator Action"

6. TVA's letter to NRC dated May 23, 2002, "Watts Bar Nuclear Plant – Request For Additional Information (RAI) Regarding Radiological Impact (TAC NO. MB1884)"

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
DOCKET NUMBER 390

PROPOSED TECHNICAL SPECIFICATIONS CHANGE (MARK-UP)

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1. AFFECTED TS PAGES

   TS 3.5-2
   TS 3.5-10
   TS 4.0-1
   TS 5.0-29
   TS 5.0-30

2. see attached

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.1.1	Verify each accumulator isolation valve is fully open.	12 hours
SR 3.5.1.2	Verify borated water volume in each accumulator is ≥ 7630 gallons and ≤ 8000 gallons.	12 hours
SR 3.5.1.3	Verify nitrogen cover pressure in each accumulator is ≥ 610 psig and ≤ 660 psig	12 hours
SR 3.5.1.4	------------------------------NOTE------------------------------ The number of TPBARs in the reactor core is contained in the Core Operating Limits Report (COLR) for each operating cycle. -- Verify boron concentration in each accumulator is as provided below depending on the number of tritium producing burnable absorber rods (TPBARs) installed in the reactor core for this operating cycle: Number of TPBARs: 0-400 — Boron Concentration Ranges: ≥ 3000 ppm and ≤ 3300 ppm	31 days AND -------NOTE---------- Only required to be performed for affected accumulators. -------------------------- Once within 6 hours after each solution volume increase of ≥ 75 gallons, that is not the result of addition from the refueling water storage tank.

(continued)

Verify boron concentration in each accumulator is within the designated discrete level as specified in the COLR. The boron concentration range for each level is defined below:

Levels	**Boron Concentration Ranges**
1	≥ 2600 ppm and ≤ 3800 ppm
2	≥ 3000 ppm and ≤ 3800 ppm
3	≥ 3500 ppm and ≤ 3800 ppm

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	-----NOTE----- Only required to be performed when ambient air temperature is < 60°F or > 105°F. ----- Verify RWST borated water temperature is ≥ 60°F and ≤ 105°F.	24 hours
SR 3.5.4.2	Verify RWST borated water volume is ≥ 370,000 gallons.	7 days
SR 3.5.4.3	-----NOTE----- The number of TPBARs in the reactor core is contained in the Core Operating Limits Report (COLR) for each operating cycle. ----- ~~Verify boron concentration in the RWST is as provided below depending on the number of tritium producing burnable absorber rods (TPBARs) installed in the reactor core for this operating cycle:~~ ~~Number of TPBARS: 0-400 — Boron Concentration Ranges: ≥ 3100 ppm and ≤ 3300 ppm~~ Verify boron concentration in the RWST is within the designated discrete level as specified in the COLR. The boron concentration range for each level is defined below:	7 days

Levels	Boron Concentration Ranges
1	≥ 2700 ppm and ≤ 3800 ppm
2	≥ 3100 ppm and ≤ 3800 ppm
3	≥ 3600 ppm and ≤ 3800 ppm

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 Zircalloy or Zirlo 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 ~~400~~ 2304 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 boron carbide with silver indium cadmium tips as approved by the NRC.

(continued)

5.9 Reporting Requirements (continued)

5.9.5 CORE OPERATING LIMITS REPORT (COLR)

a. Core operating limits shall be established prior to the initial and each reload cycle, or prior to any remaining portion of a cycle, and shall be documented in the COLR for the following:

LCO 3.1.4	Moderator Temperature Coefficient
LCO 3.1.6	Shutdown Bank Insertion Limit
LCO 3.1.7	Control Bank Insertion Limits
LCO 3.2.1	Heat Flux Hot Channel Factor
LCO 3.2.2	Nuclear Enthalpy Rise Hot Channel Factor
LCO 3.2.3	Axial Flux Difference
LCO 3.9.1	Boron Concentration

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC. When an initial assumed power level of 102 percent of rated thermal power is specified in a previously approved method, 100.6 percent of rated thermal power may be used only when feedwater flow measurement (used as input for reactor thermal power measurement) is provided by the leading edge flowmeter (LEFM) as described in document number 6 listed below. When feedwater flow measurements from the LEFM are unavailable, the originally approved initial power level of 102 percent of rated thermal power (3411 MWt) shall be used.

The approved analytical methods are specifically those described in the following documents:

1. WCAP-9272-P-A, WESTINGHOUSE RELOAD SAFETY EVALUATION METHODOLOGY," July 1985 (W Proprietary). (Methodology for Specifications 3.1.4 - Moderator Temperature Coefficient, 3.1.6 - Shutdown Bank Insertion Limit, 3.1.7 - Control Bank Insertion Limits, 3.2.1 - Heat Flux Hot Channel Factor, 3.2.2 - Nuclear Enthalpy Rise Hot Channel Factor, 3.2.3 - Axial Flux Difference, and 3.9.1 - Boron Concentration.

2a. WCAP-12945-P-A, Volume I (Revision 2) and Volumes 2 through 5 (Revision 1), "Code Qualification Document for Best-Estimate Loss of Coolant Analysis," March 1998 (W Proprietary). (Methodology for Specification 3.2.1 - Heat Flux Hot Channel Factor, and 3.2.2 - Nuclear Enthalpy Rise Hot Channel Factor).

b. WCAP-10054-P-A, "Small Break ECCS Evaluation Model Using NOTRUMP Code," August 1985. Addendum 2, Rev. 1: "Addendum to the Westinghouse Small Break ECCS Evaluation Model using the NOTRUMP Code: Safety Injection into the Broken Loop and COSI Condensation Model," July 1997. (W Proprietary). (Methodology for Specifications 3.2.1 - Heat Flux Hot Channel Factor, and 3.2.2 - Nuclear Enthalpy Rise Hot Channel Factor).

(continued)

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).

> Insert New Reference:
>
> 10. WCAP-16932-P, Rev. 1, "Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1," July 2008, (W Proprietary), as approved by the NRC staff's Safety Evaluation accompanying the issuance of Amendment No. __ (Methodology for Specification 3.5.1 - Accumulators and Specification 3.5.1 - Refueling Water Storage Tank).

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

(continued)

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
DOCKET NUMBER 390

PROPOSED TECHNICAL SPECIFICATIONS BASES CHANGE (MARK-UP)
(FOR INFORMATION ONLY)

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1. AFFECTED TS BASES PAGES

   TS B3.5-4
   TS B3.5-8
   TS B3.5-26
   TS B3.5-27
   TS B3.5-29

2. see attached

BASES

APPLICABLE SAFETY ANALYSES (continued)

water volume is the same as the deliverable volume for the accumulators, since the accumulators are emptied, once discharged. The safety analysis assumes values of 7518 gallons and 8191 gallons. To allow for instrument inaccuracy, values of 7630 gallons and 8000 gallons are specified.

> The accumulator boron concentration increases with the number of TPBARs. The accumulator boron concentration; however, is not strictly a function of TPBARs. Core enrichment and total neutron absorption affect boron worth, which impacts core subcriticality and the required accumulator boron concentration. Changes in cycle energy requirements and core reactivity (e.g., previous cycle burnup) can also affect accumulator boron levels. Therefore, the accumulator boron concentration, taking all of these parameters into account, is defined as "discrete levels." This will allow greater operational flexibility to utilize the three minimum accumulator boron concentrations (2600, 3000, and 3500 ppm). These discrete levels are specified in the COLR. Level 1 range is from 2600 to 3800 ppm. Level 2 range is from 3000 to 3800 ppm. Level 3 range is from 3500 to 3800 ppm. The end values are included in the ranges.

The minimum boron concentration setpoint is used in the post LOCA boron concentration calculation. The calculation is performed to assure reactor subcriticality in a post LOCA environment. Of particular interest is the large break LOCA, since no credit is taken for control rod assembly insertion. A reduction in the accumulator minimum boron concentration would produce a subsequent reduction in the available containment sump concentration for post LOCA shutdown and an increase in the maximum sump pH. The maximum boron concentration is used in determining the cold leg to hot leg recirculation injection switchover time and minimum sump pH.

The small break LOCA analysis is performed at the minimum nitrogen cover pressure, since sensitivity analyses have demonstrated that higher nitrogen cover pressure results in a computed peak clad temperature benefit. The maximum nitrogen cover pressure analysis limit of 690 psig prevents accumulator relief valve actuation, and ultimately preserves accumulator integrity. The LOCA analyses support a range of 585 to 690 psig. To account for the accumulator tank design pressure rating, and to allow for instrument accuracy values of ≥ 610 psig and ≤ 660 psig are specified for the pressure indicator in the main control room.

The effects on containment mass and energy releases from the accumulators are accounted for in the appropriate analyses (Refs. 2 and 4).

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.1.4

The boron concentration should be verified to be within required limits for each accumulator every 31 days since the static design of the accumulators limits the ways in which the concentration can be changed. The 31 day Frequency is adequate to identify changes that could occur from mechanisms such as stratification or inleakage. Sampling the affected accumulator within 6 hours after a 75 gallons (1% volume) increase will identify whether inleakage has caused a reduction in boron concentration to below the required limit. This is consistent with the recommendation of NUREG-1366 (Ref. 5).

The required limits are defined as discrete levels and are specified in the COLR.

SR 3.5.1.5

Verification every 31 days that power is removed from each accumulator isolation valve operator when the pressurizer pressure is ≥1000 psig ensures that an active failure could not result in the undetected closure of an accumulator motor operated isolation valve. If this were to occur, only two accumulators would be available for injection given a single failure coincident with a LOCA. Since power is removed under administrative control, the 31 day Frequency will provide adequate assurance that power is removed.

This SR allows power to be supplied to the motor operated isolation valves when pressurizer pressure is < 1000 psig, thus allowing operational flexibility by avoiding unnecessary delays to manipulate the breakers during plant startups or shutdowns. Even with power supplied to the valves, inadvertent closure is prevented by the RCS pressure interlock associated with the valves.

Should closure of a valve occur in spite of the interlock, the SI signal provided to the valves would open a closed valve in the event of a LOCA. This design feature still exists, but is no longer required for accident mitigation.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

volume. *The deliverable volume limit is set by the LOCA and containment* analyses. For the RWST, the deliverable volume is different from the total volume contained since, due to the design of the tank, more water can be contained than can be delivered. The minimum boron concentration is an explicit assumption in the main steam line break (MSLB) analysis to ensure the required shutdown capability. The maximum boron concentration is an explicit assumption in the inadvertent ECCS actuation analysis, although it is typically a nonlimiting event and the results are very insensitive to boron concentrations. The maximum temperature ensures that the amount of cooling provided from the RWST during the heatup phase of a feedline break is consistent with safety analysis assumptions; the minimum is an assumption in both the MSLB and inadvertent ECCS actuation analyses, although the inadvertent ECCS actuation event is typically nonlimiting.

The MSLB analysis has considered a delay associated with the interlock between the VCT and RWST isolation valves, and the results show that the departure from nucleate boiling design basis is met. The delay has been established as 27 seconds, with offsite power available, or 37 seconds without offsite power.

> The RWST boron concentration increases with the number of TPBARs. The RWST boron concentration; however, is not strictly a function of TPBARs. Core enrichment and total neutron absorption affect boron worth, which impacts core subcriticality and the required RWST boron concentration. Changes in cycle energy requirements and core reactivity (e.g., previous cycle burnup) can also affect RWST boron levels. Therefore, the RWST boron concentration, taking all of these parameters into account, is defined as "discrete levels." This will allow greater operational flexibility to utilize the three RWST boron concentrations (2700, 3100, and 3600 ppm). These discrete levels are specified in the COLR. Level 1 range is from 2700 to 3800 ppm. Level 2 range is from 3100 to 3800 ppm. Level 3 range is from 3600 to 3800 ppm. The end values are included in the ranges.

~~Technical Specification Surveillance Requirements 3.5.1.4, "Accumulators," and 3.5.4.3, "RWST," match boron concentrations to the number of tritium producing burnable absorbers rods (TPBARs) installed in the reactor core. Watts Bar is authorized to place a maximum of 400 TPBARs into the reactor in an operating cycle. Generally, TPBARs act as burnable absorber rods normally found in similar reactor core designs. However, unlike burnable absorber rods which lose their poison effects over the life of the cycle, some residual effect remains in the TPBARs at the end of the cycle. When larger amounts of excess neutron poisons (as in the case with larger loads of TPBARs) are added to a core, there is competition for neutrons from all the poison and the negative worth of each poison (including the reactor coolant system (RCS) boron) decreases. The positive reactivity insertion due to the negative moderator coefficient that occurs during the cooldown from hot full power to cold conditions following a loss of coolant accident (LOCA) must be overcome by RCS boron. Because the RCS boron is worth less, it takes a higher concentration to maintain subcriticality.~~

For a large break LOCA Analysis, the minimum water volume limit of 370,000 gallons and the minimum boron concentration limit is used to compute the post LOCA sump boron concentration necessary to assure subcriticality. This

(continued)

operational and design parameters and is

APPLICABLE SAFETY ANALYSES (continued)

minimum value depends on ~~the number of TPBARs in the core as~~ specified in the Core Operating Limits Report (COLR) for each operating cycle. The large *break LOCA is the limiting case since the safety analysis assumes least negative* reactivity insertion.

3800

The upper limit on boron concentration of ~~3300~~ ppm is used to determine the maximum allowable time to switch to hot leg recirculation following a LOCA. The purpose of switching from cold leg to hot leg injection is to avoid boron *precipitation in the core following the accident.*

In the ECCS analysis, the containment spray temperature is assumed to be equal to the RWST lower temperature limit of 60°F. If the lower temperature limit is violated, the containment spray further reduces containment pressure, which decreases the rate at which steam can be vented out the break and increases peak clad temperature. The acceptable temperature range of 60°F to 105°F is assumed in the large break LOCA analysis, and the small break analysis value bounds the upper temperature limit of 105°F. The upper temperature limit of 105°F is also used in the containment OPERABILITY analysis. Exceeding the upper temperature limit will result in a higher peak clad temperature, because there is less heat transfer from the core to the injected water following a LOCA *and higher containment pressures due to reduced containment spray cooling* capacity. For the containment response following an MSLB, the lower limit on boron concentration and the upper limit on RWST water temperature are used to maximize the total energy release to containment.

The RWST satisfies Criterion 3 of the NRC Policy Statement.

LCO

The RWST ensures that an adequate supply of borated water is available to cool and depressurize the containment in the event of a Design Basis Accident (DBA), to cool and cover the core in the event of a LOCA, to maintain the reactor subcritical following a DBA, and to ensure adequate level in the containment sump to support ECCS and Containment Spray System pump operation in the recirculation mode.

To be considered OPERABLE, the RWST must meet the water volume, boron concentration, and temperature limits established in the SRs.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.5.4.1

The RWST borated water temperature should be verified every 24 hours to be within the limits assumed in the accident analyses band. The specified temperature range is ≥ 60°F and ≤ 105°F and does not account for instrument error (Ref. 2). The 24 hour Frequency is sufficient to identify a temperature change that would approach either limit and has been shown to be acceptable through operating experience.

The SR is modified by a Note that eliminates the requirement to perform this Surveillance when ambient air temperatures are within the operating limits of the RWST. With ambient air temperatures within the band, the RWST temperature should not exceed the limits.

SR 3.5.4.2

The required minimum RWST water level is ≥370,000 gallons (value does not account for instrument error, Ref. 2). Verification every 7 days of the presence of this water volume ensures that a sufficient initial supply of water is available for injection and to support continued ECCS and Containment Spray System pump operation on recirculation. Since the RWST volume is normally stable and is protected by an alarm, a 7 day Frequency is appropriate and has been shown to be acceptable through operating experience.

The required limits are defined as discrete levels and are specified in the COLR.

SR 3.5.4.3

The boron concentration of the RWST should be verified every 7 days to be within the required limits. This SR ensures that the reactor will remain subcritical following a LOCA. Further, it assures that the resulting sump pH will be maintained in an acceptable range so that boron precipitation in the core will not occur and the effect of chloride and caustic stress corrosion on mechanical systems and components will be minimized. Since the RWST volume is normally stable, a 7 day sampling Frequency to verify boron concentration is appropriate and has been shown to be acceptable through operating experience.

(continued)

ENCLOSURE 4

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
DOCKET NUMBER 390

PROPOSED UFSAR CHANGE (MARK-UP)
(FOR INFORMATION ONLY)

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1. AFFECTED UFSAR PAGES

   5.2-32
   5.2-70
   6.3-13
   6.3-36
   15.4-13

5.2.1.10.8 Computer Program Descriptions

The following computer programs have been used in dynamic and static analyses to determine mechanical loads, stresses, and deformations of Seismic Category I components and equipment[3],[10],[19].

1. WESTDYN - static and dynamic analysis of redundant piping systems.

2. WESAN - reactor coolant loop equipment support structures analysis and evaluation.

3. WECAN - finite element structural analysis.

4. PIPESTRESS - static and dynamic analysis of piping systems.

5. ANSYS - finite element structural analysis.

5.2.1.10.9 LOCA Evaluation of the Control Rod Drive Mechanisms

The response of the control rod drive mechanisms (CRDMs) to the postulated reactor vessel inlet nozzle and outlet nozzle limited displacement breaks has been evaluated. The time history analysis of the mechanism has been performed for the vessel motion developed previously. A one row model of the CRMDs was formulated with gaps at the upper CRDM support modeled as nonlinear elements. The CRDM's were represented by beam elements with lumped masses. The translation and rotation of the vessel head was applied to this model (see Figure 5.2-12). The resulting loads and stresses were compared to allowables to verify the adequacy of the system. The highest loads occur at the head adapter, the location where the mechanisms penetrate the vessel head. The bending moments at this location are presented in Table 5.2-21 for the longest and shortest CRDM. The combined effect including seismic loads is shown to be less than the allowable bending moment at this location.

5.2.1.11 Analysis Methods For Faulted Conditions

The methods used for the evaluation of the Faulted Conditions are contained in Section 5.2.1.10.

5.2.1.12 Protection Against Environmental Factors

A discussion of the protection provided for the principal components of the RCS against environmental factors is found in Section 3.11.

Add to LOCA evaluation paragraph:

The evaluation of control rod driveline, CRDM seismic support platform assembly, pressure boundary, and head adapter for cold leg LOCA [20] showed that structural integrity was maintained by meeting the allowable limits.

5. Nay, J. A., "Process Instrumentation for Westinghouse Nuclear Steam Supply Systems," WCAP-7547-L (Proprietary) and WCAP-7671 (Non-Proprietary), April 1971.

6. Hazelton, W. S., et al., "Basis for Heatup and Cooldown Limit Curves," WCAP-7924-A, April 1975.

7. Golik, M. A., "Sensitized Stainless Steel in Westinghouse PWR Nuclear Steam Supply Systems," WCAP-7477-L (Proprietary), March 1970 and WCAP-7735 (Non-Proprietary), August 1971.

8. Enrietto, J. F., "Control of Delta Ferrite in Austenitic Stainless Steel Weldments," WCAP-8324-A, June 1974.

9. Shabbits, W. O., "Dynamic Fracture Toughness Properties of Heavy Section A533 Grade B Class 1 Steel Plate," WCAP-7623, December 1970.

10. "Bench Marks Problem Solutions Employed for Verification of WECAN Computer Program," WCAP-8929, June 1977.

11. K. Takeuchi, et. al., "MULTIFLEX - a Fortran-IV Computer Program for Analyzing Thermal-Hydraulic-Structure System Dynamics," WCAP-8708, February 1976.

12. Nuclear Technology, Vol. 37, January 1978, "Probablistic Analysis of the Interfacing System Loss-of-Coolant Accident and Implications on Design Decisions."

13. Chiiots, J. M., "Evaluation of Pressurized Thermal Shock for Watts Bar Unit 1," WCAP 13300, Revision 1, December 1992, and "Evaluation of Pressurized Thermal Shock for Watts Bar Unit 2," WCAP 13301 Revision 1, December 1992.

14. System Description N3-68-4001, Appendix "A", Pressure, Temperature, Limits Report (PTLR).

15. NRC letter to Holders of Licenses for Operating PWRs as listed in Attachment to the Enclosed Order, dated February 11, 2003 (L44030218002), "Issuance of Order Establishing Interim Inspection Requirements for Reactor Vessel Heads at PWRs."

16. TVA letter to NRC, dated February 27, 2003 (L44030227801) responding to NRC's Order EA-03-009, dated February 11, 2003.

17. NRC J. Strosnider's letter to A. Marion, Nuclear Energy Institute (NEI) dated November 21, 2001.

18. TVA's letter to NRC dated July 30, 2003, Petition Pursuant to 10 CFR 2.206 – Reactor Coolant System Stainless Steel Cladding.

19. PIPESTRESS Computer code, DST Computer Services S.A., Geneva, Switzerland.

Insert New Reference:

20. WCAP-16932-P, Rev. 1, "Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1 ," July 2008, (W Proprietary), as approved by the NRC staffs Safety Evaluation accompanying the issuance of Amendment No. - .

The sequence (as delineated in Table 6.3-3) is followed regardless of which power supply is available (offsite or emergency onsite).

The time required to complete the sequence is essentially the time required for the operator to perform the accompanying manual operations. Controls for ECCS components are grouped together on the main control board. The component position lights indicate equipment position/status.

After the injection operation, water collected in the containment sump is cooled and returned to the RCS by the low head/high head recirculation flow path. The low head recirculation flow path consists of the RHR pumps taking suction from the containment sump and discharging the flow directly to the RCS through the residual heat exchangers and cold leg injection lines. The high head recirculation flow path consists of the RHR pumps taking suction from the containment sump and discharging the flow through the residual heat exchangers to the suction of the centrifugal charging pumps and safety injection pumps. The flow from the centrifugal charging pumps and safety injection pumps is returned to the RCS through the cold leg injection lines. The latter mode of operation assures flow in the event of a small rupture where the depressurization proceeds more slowly such that the RCS pressure is still in excess of the shutoff head of the RHR pumps at the onset of recirculation.

Approximately 3 hours after event initiation, hot leg recirculation will be initiated to assure against an excessive buildup of boric acid in the core.

The containment sump isolation valve is interlocked with its respective pump suction/RWST isolation valve to the RHR system. The interlock is provided with redundant signals from each isolation valve. This interlock prevents remote manual opening the sump isolation valve when the RWST isolation valves are open and thus prevents dumping the RWST contents into the containment sump. However, when an accident signal is present, this interlock is bypassed to allow initiation of the switchover sequence.

The RWST is protected from back flow of reactor coolant from the RCS. All connections to the RWST are provided with check valves to prevent back flow. When the RCS is hot and pressurized there is no direct connection between the RWST and the RCS. When the RCS is being cooled and the RHR system is placed in service, the RHR system is isolated from the RWST by a motor-operated valve in addition to a check valve.

Insert new paragraph:
During the initial injection phase following the LOCA, no credit is taken for control rod insertion. The core is initially shutdown on voiding and maintained sub-critical on the basis of the boric acid concentration in the fluid from accumulators and RWST that initiates refill and reflood of the vessel. In the long term post-LOCA, after recirculation from the RWST to the sump is established, the concern has been identified that Tritium Producing Burnable Absorber Rods (TPBARs) could fail and their contents leach out of the fuel assemblies. An analysis, reviewed and approved by the NRC, has been documented in Reference 1 which demonstrated that control rod insertion will occur. The purpose of this analysis is to allow credit for negative reactivity from control rods to be taken to demonstrate that the core will remain sub-critical in the long term post-LOCA even if the TPBARs fail.

Cold Leg Accumulator Level

Two water level channels are provided for each tank which indicate and alarm the water level in the main control room. The common low and high level alarms ensure adequate accumulator water level.

Containment Sump Water Level

Four containment sump water level indicator channels provide the control room with water level indication and also provide a permissive signal (2 out of 4 logic) to initiate the auto-switchover from the injection to recirculation mode. A common main control room alarm is used to identify a high containment water level condition.

6.3.5.5 Valve Position Indication

The majority of the engineered safety features remote-operated valves have red and green lights on the control board to indicate valve position. The exceptions to this are discussed in Section 7.3.

Accumulator Isolation Valve Position Indication

The accumulator isolation valves are provided with red (open) and green (closed) position indication lights located on the main control room hand switch for each valve. These lights are powered by valve control power and actuated by valve motor operator limit switches.

Refueling Water Storage Tank Isolation Valve

The RWST isolation valve is provided with red (open) and green (closed) position indication lights located on the main control room hand switch. These lights are powered by valve control power and actuated by valve motor operator limit switch.

REFERENCES

None

Delete

Insert new reference:

1. WCAP- 16932-P, Rev. 1, "Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1," July 2008, (W Proprietary), as approved by the NRC staffs Safety Evaluation accompanying the issuance of Amendment No. ____.

The estimate of the PCT at 95% probability is determined by finding that PCT below which 95% of the calculated PCTs reside. This estimate is the licensing basis PCT, under the revised ECCS rule. The results of the WBN Best Estimate Large Break LOCA analysis are presented in Table 15.4-18. The difference between the 95th percentile PCT and the 50th percentile PCT increases during reflood due to propagation of uncertainties.

15.4.1.1.4.7 Evaluations

Replacement of V+/P+ fuel with RFA-2 fuel has been evaluated for its effect on the large break loss of coolant accident peak cladding temperature. Calculations using WCOBRA/TRAC were performed with the Double Ended Guilletine Transient conditions to determine the effects of a full core of RFA-2 fuel with intermediate flow mixers (IFMs) and a mixed core of V+/P+ and RFA-2 fuels. One mixed core modeled fresh RFA-2 fuel in the hot assembly surrounded by a least once burned V+/P+ fuel in the average fuel assemblies and the low power assemblies. The second mixed core modeled fresh RFA-2 fuel in the hot assembly and in the average fuel assemblies under guide tubes with the remainder at least once burned V+/P+ fuel. A minimum burnup of 8,000 MWD/MTU was assumed for all of the V+/P+ assemblies.

The analysis was performed using the current approved methodology and the same version of WCOBRA/TRAC. The calculated maximum PCT for each case considered remained below the PCT calculated for the calculation. The Best Estimate LBLOCA evaluation concludes that, with the new fuel and limiting transition core, WBN remains in compliance with the requirements of 10 CFR 50.46 for both the tranisition from the current fuel to the new fuel and for a full core of the new fuel. Assessments related to plant safety will remain.

Replacement Steam Generators (RSGs) have been evaluated for their effect on the large break loss of coolant accident peak cladding temperature. Calculations using WCOBRA/TRAC were performed to determine the PCT effects of the new steam generators (Westinghouse model 68AXP). The evaluation concluded that the PCT effects of the RSGs are bounded by the PCT effects of the original D-3 steam generators that were originally modeled. As such, the evaluation shows continued compliance with the requirements of 10 CFR 50.46. Other margin assessments related to plant safety will remain applicable.

15.4.1.1.5 Effect of Containment Purging

To assess the impact of purging on the calculated post-LOCA Watts Bar containment pressure, a calculation was performed to obtain the amount of mass which exits through two available purge lines during the initial portion of a postulated LOCA transient. Purge line isolation closure time is assumed at 4.0 seconds after receipt of signal; during this interval, the full flow area is presumed available. In addition, the time to reach the SI signal setpoint and the delay necessary to generate the SI signal are conservatively assessed as 1.5 seconds total. Thus, flow through a pair of fully open available purge lines was evaluated from 0.0 to 5.5 seconds for the postulated Double-Ended Cold Leg break. When the CVI signal is generated by the safety injection signal from the reactor protection system, a maximum response time of 2.0 seconds is allocated, thereby resulting in a total isolation time of 6.0 seconds.

Insert A here

Insert A for Chapter 15.4, page 15.4-13; pointer to discussion of control rod insertion in Chapter 6.3, page 6.3-13:

Evaluation of control rod insertion following a large break loss-of-coolant accident is discussed in Section 6.3. Note that no credit for control rod insertion is taken in the large break LOCA analysis described in this section.

Confidential Information Submitted Under 10 CFR 2.390 – Proprietary

ENCLOSURE 5

Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1

WCAP16932-P
(Proprietary Version)

ENCLOSURE 6

Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1

WCAP16932-P
(Non- Proprietary Version)

ENCLOSURE 7

Westinghouse Affidavit
Proprietary Information Notice
Copyright Notice

Westinghouse

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Our ref: CAW-08-2434

June 6, 2008

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-16932-P, "Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-08-2434 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by TVA Nuclear.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-08-2434, and should be addressed to J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: J. Thompson, NRC

bcc: J. A. Gresham (ECE 4-7A) 1L
R. Bastien, 1L (Nivelles, Belgium)
C. Brinkman, 1L (Westinghouse Electric Co., 12300 Twinbrook Parkway, Suite 330, Rockville, MD 20852)
RCPL Administrative Aide (ECE 4-7A) 1L, 1A (letter and affidavit only)
B. Gergos (ECE 4-7A) 1L, 1A

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared J. A. Gresham, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

J. A. Gresham, Manager
Regulatory Compliance & Plant Licensing

Sworn to and subscribed before
me this 6th day of June, 2008

Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Sharon L. Markle, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Jan. 29, 2011
Member, Pennsylvania Association of Notaries

(1) I am Manager, Regulatory Compliance & Plant Licensing, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse "Application for Withholding" accompanying this Affidavit.

(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 the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, 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.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

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.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in WCAP-16932-P, "Control Rod Insertion Following a Cold Leg LOCA for Watts Bar Unit 1" (Proprietary), dated June 2008, being transmitted by TVA Nuclear letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted for use by Westinghouse for Watts Bar Unit 1 is expected to be applicable for other licensee submittals in response to certain NRC requirements for justification of demonstrating control rod insertion following a cold leg loss of coolant accident (LOCA).

This information is part of that which will enable Westinghouse to:

(a) Demonstrate control rod insertion following a cold leg loss of coolant accident (LOCA).

(b) Provide customer specific calculations.

(c) Provide licensing support for customer submittals.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for licensing documentation associated with demonstrating control rod insertion following a cold leg LOCA.

(b) Westinghouse can sell support and defense of the technology to its customer in the licensing process.

(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

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 information 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.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary 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 (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).