Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-16-192

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

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

Subject: **Application to Modify the Watts Bar Nuclear Plant Unit 2 Ice Mass Limit in Technical Specification Surveillance Requirements 3.6.11.2 and 3.6.11.3 (WBN-TS-16-026)**

References:

1. NRC letter to TVA, "Watts Bar Nuclear Plant, Unit 1 — Issuance of Amendment Regarding Technical Specification Change to Increase Containment Ice Condenser Ice Weight to Support Replacement Steam Generators (TAC No. MC9270)," dated July 25, 2006 (ML061830005)

2. NRC Letter to Westinghouse Electric Company, "Acceptance for Referencing of Licensing Topical Report WCAP-10325, 'Westinghouse LOCA Mass and Energy Release Model for Containment Design Proprietary - March 1979 Version'," dated February 17, 1987 (8702200098)

3. TVA letter to NRC, CNL-15-126, "Notification of Revised Westinghouse Containment Integrity Analysis," dated September 11, 2015 (ML15254A564)

4. NRC Letter to Westinghouse Electric Company, "Final Safety Evaluation for Westinghouse Electric Company (Westinghouse) Topical Report (TR) WCAP-17721-P, Revision 0, and WCAP-17721-NP, Revision 0, 'Westinghouse Containment Analysis Methodology – PWR [Pressurized Water Reactor] LOCA [Loss-of-Coolant Accident] Mass and Energy Release Calculation Methodology'," dated August 24, 2015 (ML15221A005)

5. TVA letter to NRC, CNL-16-159, "Application to Modify Watts Bar Nuclear Plant Unit 2 Technical Specifications to Extend Surveillance Requirement (SR) Intervals for SRs 3.6.11.2 and 3.6.11.3 (WBN-TS-16-022)," dated September 30, 2016 (ML16277A477)

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

The proposed change revises the ice mass limits in Technical Specification (TS) Surveillance Requirements (SRs) 3.6.11.2 and 3.6.11.3 as follows:

- Revises SR 3.6.11.2 to change the total weight of stored ice from greater than or equal to (≥) 2,750,700 pounds (lb) to ≥2,404,500 lb.
- Revises SR 3.6.11.2 to change the ice limit of each basket from ≥1,415 lb to ≥1,237 lb.
- Revises SR 3.6.11.3 to change the average ice weight of the sample baskets from ≥1,415 lb to ≥1,237 lb.

The proposed changes are identical to the ice mass limits in the WBN Unit 1 TS SRs 3.6.11.2 and 3.6.11.3, which were approved by the NRC in Reference 1 in support of the replacement steam generators (RSGs) for WBN Unit 1. The current WBN Unit 1 ice mass limits were originally based on the loss of coolant accident (LOCA) mass and energy (M&E) methodology in WCAP-10325-P-A, "Westinghouse LOCA Mass and Energy Release Model for Containment Design," that was approved by the NRC in Reference 2. This methodology is also the basis for the current WBN Unit 2 ice mass limits as noted in Section 6.2 of the WBN Unit 2 portion of the WBN dual-unit Updated Final Safety Analysis Report (UFSAR).

In Reference 3, TVA notified NRC that the WBN Unit 1 LOCA M&E methodology was revised to WCOBRA/TRAC (WCAP-17721-P), which was approved by the NRC in Reference 4. Reference 3 also provided the NRC with a copy of WCAP-17834-P, Revision 1, "Watts Bar Unit 1 WCOBRA/TRAC Long Term LOCA M&E and Containment Integrity Analysis." As noted in Reference 3, the WCOBRA/TRAC LOCA M&E methodology addressed Nuclear Safety Advisory Letter (NSAL) 11-5 and other issues with the prior methodology. The long-term containment integrity analysis demonstrated that containment pressure was significantly below design pressure, and did not require a change to the WBN Unit 1 ice mass limits.

As part of the TVA effort to align the WBN Unit 1 and Unit 2 LOCA M&E methodology, the current ice mass limits for WBN Unit 2 have been evaluated with respect to the limits supported by the current WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology. As noted in the enclosure to this letter, a comprehensive review was performed to demonstrate that WBN Unit 1 bounds WBN Unit 2 from a LOCA M&E and containment integrity perspective. Also as noted in the enclosure to this letter, the analysis performed using the WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology is conservative, in comparison to WBN Unit 2, because it is modeled on the WBN Unit 1 RSGs, which have a greater mass, volume, and stored metal energy than the WBN Unit 2 original model D3 SGs.

The proposed change to the WBN Unit 2 ice mass limits in SRs 3.6.11.2 and 3.6.11.3 achieves greater efficiency in the alignment of maintenance and surveillance activities for both units during refueling outages. Therefore, TVA requests approval of this proposed license amendment by September 1, 2017, to support the upcoming WBN Unit 2 refueling outage (R1) scheduled to commence in October 2017, with implementation within 30 days following NRC approval.

Enclosure 1 to this letter provides a description of the proposed TS change, a technical evaluation of the proposed TS change, regulatory evaluation, and a discussion of environmental considerations. Attachments 1 and 2 to Enclosure 1 provide the existing TS and Bases pages marked-up to show the proposed changes, respectively. Attachments 3 and 4 to Enclosure 1 provide the existing TS and Bases pages retyped to show the proposed changes, respectively. Attachments 1 and 3 also reflect changes to proposed Table SR 3.0.2-1 that was submitted in Reference 5.

Changes to the existing TS Bases are provided for information only and will be implemented under the Technical Specification Bases Control Program.

The WBN Plant Operations Review Committee and the TVA Nuclear Safety Review Board have reviewed this proposed change and determined that operation of WBN Unit 2 in accordance with the proposed change will not endanger the health and safety of the public.

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the TS change qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and enclosures to the Tennessee State Department of Environment and Conservation.

Please address any questions regarding this request to Edward Schrull at (423) 751-3850.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 21st day of December 2016.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosure

cc: See Page 4

Enclosure: Evaluation of Proposed Technical Specification Change

cc (Enclosures):

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

Enclosure

Evaluation of Proposed Technical Specification Change

Subject: **Application to Modify the Watts Bar Nuclear Plant Unit 2 Ice Mass Limit in Technical Specification Surveillance Requirements 3.6.11.2 and 3.6.11.3 (WBN-TS-16-026)**

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Evaluation of Proposed Technical Specification Change

1.0 SUMMARY DESCRIPTION

This evaluation supports a request to amend Facility Operating License No. NPF-96 for the Tennessee Valley Authority (TVA) Watts Bar Nuclear Plant (WBN), Unit 2. The proposed amendment revises the WBN Unit 2 ice mass limits in Technical Specification (TS) Surveillance Requirements (SRs) 3.6.11.2 and 3.6.11.3 to be identical to the ice mass limits in the WBN Unit 1 TS SRs 3.6.11.2 and 3.6.11.3. As part of the TVA effort to align the WBN Unit 1 and Unit 2 loss of coolant accident (LOCA) mass and energy (M&E) methodology, the current ice mass limits for WBN Unit 2 have been evaluated with respect to the limits supported by the WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology. In order to determine if the WBN Unit 1 LOCA M&E and containment integrity analyses can be applied to WBN Unit 2, TVA performed a detailed comparison of the WBN Unit 2 primary system design, operating parameters, reactor protection features, emergency core cooling system (ECCS) capabilities, fuel design, containment design and analytical inputs to those modeled in the WBN Unit 1 analyses (see Tables 1 and 2)

The analysis performed using the WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology is conservative, in comparison to WBN Unit 2 because it is modeled on the WBN Unit 1 replacement steam generators (RSGs) (Model 68AXP), which have a greater mass, volume, and stored metal energy than the WBN Unit 2 original model D3 SGs. The proposed change to the WBN Unit 2 ice mass limits in SRs 3.6.11.2 and 3.6.11.3 will achieve greater efficiency in the alignment of maintenance and surveillance activities for both units during refueling outages.

2.0 DETAILED DESCRIPTION

2.1 PROPOSED CHANGES

The proposed amendment revises the WBN Unit 2 ice mass limits in TS SRs 3.6.11.2 and 3.6.11.3 as follows:

- Revises SR 3.6.11.2 to change the total weight of stored ice from greater than or equal to (≥) 2,750,700 pounds (lb) to ≥2,404,500 lb.
- Revises SR 3.6.11.2 to change the ice limit of each basket from ≥1,415 lb to ≥1,237 lb.
- Revises SR 3.6.11.3 to change the average ice weight of the sample baskets from ≥1,415 lb to ≥1,237 lb.

Attachments 1 and 2 to Enclosure 1 provide the existing TS and Bases pages marked-up to show the proposed changes, respectively. Attachments 3 and 4 to Enclosure 1 provide the existing TS and Bases pages retyped to show the proposed changes, respectively. Attachments 1 and 3 also reflect changes to proposed Table SR 3.0.2-1 that was submitted in Reference 1.

The proposed Bases changes are provided to the NRC for information only.

2.2 CONDITION INTENDED TO RESOLVE

The proposed amendment aligns the WBN Unit 1 and Unit 2 ice mass limits, which will achieve greater efficiency in maintenance and surveillance activities for both units during refueling outages.

2.3 CONDITION BACKGROUND

The proposed amendment revises the WBN Unit 2 ice mass limits in TS SRs 3.6.11.2 and 3.6.11.3 to be identical to the ice mass limits in the WBN Unit 1 TS. The ice mass limits in WBN Unit 1 TS SRs 3.6.11.2 and 3.6.11.3 were approved by the NRC in Reference 2 in support of the RSGs for WBN Unit 1 and were originally based on the LOCA M&E methodology in WCAP-10325-P-A, "Westinghouse LOCA Mass and Energy Release Model for Containment Design," that was approved by the NRC in Reference 3. This methodology is also the basis for the current WBN Unit 2 ice mass limits as noted in Section 6.2 of the WBN Unit 2 portion of the WBN dual-unit Updated Final Safety Analysis Report (UFSAR).

In Reference 4, TVA notified NRC that the WBN Unit 1 LOCA M&E methodology was revised to WCOBRA/TRAC (WCAP-17721-P), which was approved by the NRC in Reference 5. Reference 4 also provided the NRC with a copy of WCAP-17834-P, Revision 1, "Watts Bar Unit 1 WCOBRA/TRAC Long Term LOCA M&E and Containment Integrity Analysis." The LOCA long-term containment integrity analysis, using the WCAP-8354-P-A, "Long Term Ice Condenser Containment Code – LOTIC Code," (Reference 6) methodology with LOCA M&E release input, defines the minimum analytical ice mass. As noted in Reference 4, the WCOBRA/TRAC LOCA M&E methodology addressed Nuclear Safety Advisory Letter (NSAL) 11-5 and other issues with the prior methodology. Also as noted in Reference 4, the LOTIC1 analysis incorporates the changes to heat exchanger heat removal based on the dual-unit sharing of Component Cooling System (CCS) Train B. The long-term containment integrity analysis demonstrated that containment pressure was significantly below design pressure, and did not require a change to the WBN Unit 1 ice mass limits.

As part of the TVA effort to align the WBN Unit 1 and Unit 2 LOCA M&E methodology, the current ice mass limits for WBN Unit 2 have been evaluated with respect to the limits supported by the current WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology. Specifically, as discussed further in Section 3.4, the WBN Unit 2 configuration and operating conditions were reviewed using the WBN Unit 1 LOCA M&E release and long-term containment integrity analyses.

For WBN Unit 1, the primary system M&E releases were calculated using the WCOBRA/TRAC LOCA M&E methodology documented in WCAP-17721-P (Reference 5). The containment responses were calculated with the LOTIC1 ice condenser containment code documented in WCAP-8354-P-A (Reference 6). In order to determine if the WBN Unit 1 LOCA M&E and containment integrity analyses can be applied to WBN Unit 2, a detailed comparison was performed of the WBN Unit 2 primary system design, operating parameters, reactor protection features, ECCS capabilities, fuel design, containment design and analytical inputs to those modeled in the WBN Unit 1 analyses (see Tables 1 and 2). The most significant difference between WBN Units 1 and 2, as identified by the review, was the WBN Unit 1 RSGs and the WBN Unit 2 D3 SGs. The attributes of the SGs, which have the potential to affect the containment pressurization response, include the total component metal mass, heat transfer area, and fluid volume. The WBN Unit 1 RSGs have more metal mass, heat transfer area, and primary/secondary side water mass than the WBN Unit 2 D3 SGs. Therefore, it is conservative to use the WBN Unit 1 LOCA M&E and containment integrity analyses to determine the revised ice mass limit for WBN Unit 2.

3.0 TECHNICAL EVALUATION

3.1. SYSTEM DESCRIPTION

The ice bed consists of over 2,750,700 lb of ice stored in 1,944 baskets within the ice condenser. Its primary purpose is to provide a large heat sink in the event of a release of energy from a design basis accident (DBA) in containment. The ice would absorb energy and limit containment peak pressure and temperature during the accident. Limiting the pressure and temperature would reduce the release of fission product radioactivity from containment to the environment in the event of a DBA.

The ice baskets contain the ice within the ice condenser. The ice bed consists of the total volume from the bottom elevation of the ice baskets to the top elevation of the ice baskets. The ice baskets position the ice within the ice bed in an arrangement to promote heat transfer from steam to ice. This arrangement enhances the ice condenser's primary function of condensing steam and absorbing heat energy released to the containment during a DBA.

As ice melts, the water passes through the ice condenser floor drains into the lower compartment. Thus, a second function of the ice bed is to be a large source of borated water (via the containment sump) for long-term ECCS and Containment Spray System (CSS) heat removal functions in the recirculation mode.

A third function of the ice bed and melted ice is to remove fission product iodine that may be released from the core during a DBA. Iodine removal occurs during the ice melt phase of the accident and continues as the melted ice is sprayed into the containment atmosphere by the CSS. The ice is adjusted to an alkaline pH that facilitates removal of radioactive iodine from the containment atmosphere. The alkaline pH also minimizes the occurrence of the chloride and caustic stress corrosion on mechanical systems and components exposed to ECCS and CSS fluids in the recirculation mode of operation.

It is important for the ice to be uniformly distributed around the 24 ice condenser bays and for open flow paths to exist around ice baskets. This distribution is especially important during the initial blowdown so that the steam and water mixture entering the lower compartment do not pass through only part of the ice condenser, depleting the ice in some bays while bypassing the ice in other bays.

3.2. SAFETY ANALYSIS

The limiting DBAs considered relative to containment temperature and pressure are the LOCA and the steam line break (SLB). The LOCA and SLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. The limiting DBA analyses in Section 6.2 of the WBN dual-unit UFSAR show that the maximum peak containment pressure results from the LOCA analysis and is calculated to be less than the containment design pressure. Additionally, the containment pressure calculations in Section 6.2.1.3.3 of the WBN Unit 1 portion of the WBN dual-unit UFSAR state that the analytical limit for the mass of ice assumed in the WBN Unit 1 ice condenser, in order to limit the maximum containment peak pressure from a LOCA to below the containment design pressure, is 2,260,000 lb of ice. The proposed revised TS SR ice mass

limit of 2,404,500 lb includes additional ice mass to conservatively bound ice bed sublimation effects.

TS Limiting Condition for Operation (LCO) 3.6.11 requires a quantity of stored ice that exceeds the analytical value to account for the assumed loss of ice during the operating cycle due to sublimation.

3.3. ICE BED SURVEILLANCE REQUIREMENTS

The weighing program for SR 3.6.11.2 is designed to obtain a representative sample of the ice baskets. The representative sample includes six baskets from each of the 24 ice condenser bays and consists of one basket from radial rows 1, 2, 4, 6, 8, and 9. If no basket from a designated row can be obtained for weighing, a basket from the same row of an adjacent bay is weighed. The rows chosen include the rows nearest the inside and outside walls of the ice condenser (rows 1 and 2, and rows 8 and 9, respectively), where heat transfer into the ice condenser is most likely to influence melting or sublimation. Verifying the total weight of ice ensures that there is adequate ice to absorb the required amount of energy to mitigate the DBAs. The surveillance frequency of 18 months is based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses.

SR 3.6.11.3 verifies that the azimuthal distribution of ice is reasonably uniform, by verifying that the average ice weight in each of three azimuthal groups of ice condenser bays is within the limit. The surveillance frequency of 18 months is based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. As noted in the SR 3.6.11.3 Bases, operating experience has verified that, with the 18-month frequency, the weight requirements are maintained with no significant degradation between surveillances.

3.4 TECHNICAL ANALYSIS

3.4.1 Evaluation Method

The proposed TS SR ice mass limits for WBN Unit 2 have been evaluated with respect to the limits supported by the current WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology. The revised LOCA M&E release data used in the current WBN Unit 1 containment integrity analysis was generated using the more realistic M&E release model in WCAP-17721-P (Reference 5) and conservative inputs reflecting the WBN Unit 1 equipment and operating conditions. The containment integrity pressure response analysis for WBN Unit 1 (WCAP-17834-P) resulted in a maximum peak pressure of 9.36 pound per square inch gauge (psig) (relative to the containment internal design pressure of 13.5 psig) for the double-ended pump suction break with a loss of offsite power and an assumed failure of a diesel generator. The analysis assumed that the ice mass in containment was the minimum ice mass of 2,260,000 lb initially assumed in the ice condenser used to support the LOCA analyses in the WBN Unit 1 UFSAR. The following sections provide the justification that the results and conclusions of WCAP-17834-P are applicable to WBN Unit 2.

3.4.2 Input Parameters and Assumptions

Tables 1 and 2 to this enclosure provide a comparison of the WBN Unit 1 with RSGs to WBN Unit 2 with the original model D3 SGs along with the input parameters used to evaluate the WBN Unit 2 ice mass limits to the WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology . Specifically, Table 1 provides the LOCA M&E input comparison and Table 2 provides the containment integrity input comparison.

3.4.3 Acceptance Criteria and Description of Analyses and Evaluations

The WBN Unit 2 containment design pressure is 13.5 psig; the calculated post-LOCA pressures must remain below this limit. The acceptability of this proposed TS SR change was based upon determining that the WBN Unit 1 WCOBRA/TRAC LOCA M&E release and the LOTIC1 containment integrity analysis, which reflect the WBN Unit 1 RSGs, bounds WBN Unit 2 with Model D3 SGs. The method used to make this determination was based on comparing the inputs and conditions listed in Tables 1 and 2.

3.4.4 Results of the Evaluation

3.4.4.1 Long-Term LOCA M&E Release

Table 1 provides a summary of the LOCA M&E input comparison. The relevant trip setpoints and accumulator parameters for WBN Unit 2 with D3 SG conditions are the same as the WBN Unit 1 RSG values. Therefore, the safety injection (SI) delivery time would be the same between the units. SI flow can be split into two phases:

- Flow delivered from the refueling water storage tank (RWST), referred to as injection flow.
- Flow recirculated from the containment sump, or recirculation flow.

During the injection phase, the WBN Unit 1 flows are conservative with respect to the WBN Unit 2 flows for the pumps listed in Table 1 (i.e., biased low for peak containment pressure). Similarly, recirculation flow is biased low for peak containment pressure. As shown in Table 1, the WBN Unit 1 total recirculation flow is 37 gpm greater than the WBN Unit 2 total recirculation flow; both flow rates account for the effect of diesel generator (DG) frequency variation. The difference in the recirculation flow of 37 gpm is about 1.2 percent (%) of the total recirculation flow rate for either unit. A change of this magnitude would have a negligible impact on mass and energy releases.

Fuel modeling in the WBN Unit 1 WCOBRA/TRAC analysis considers the effects of fuel thermal conductivity degradation (TCD). TCD tends to increase fuel temperatures late in life by increasing the fuel-stored energy Therefore, the core was modeled at a bounding high burnup. The fuel product is the same for WBN Unit 1 and WBN Unit 2. Therefore, the WBN Unit 1 fuel modeling used in the analysis bounds WBN Unit 2.

The WBN Unit 1 and Unit 2 LOCA peak cladding temperature (PCT) WCOBRA/TRAC models, which are the basis for the LOCA M&E models, were maintained in parallel due to the common vessel and loop designs. A comparison of the two models and the associated documentation revealed no differences that would affect the thermal hydraulic characteristics of a LOCA M&E calculation, or in turn, the containment pressure response to a large break LOCA. With the exception of the SG, the loop and vessel components share

the same geometry, so the initial fluid volume and stored RCS energy is the same between the units. The structural metal is also the same between the units, which results in the energy stored in the vessel and loop construction materials being the same at a given temperature.

Long-term LOCA containment pressure is also influenced by the energy released from the SG secondary side into the RCS, and then out of the break. The release of secondary side energy in turn is related directly to the SG design. The attributes that contribute to the release of stored secondary energy are the total primary and secondary metal mass, heat transfer area, and secondary fluid volume. As shown in Table 1, the WBN Unit 1 RSGs have more metal mass, heat transfer area, and secondary side water mass than the WBN Unit 2 D3 SGs. Therefore, the WBN Unit 1 RSGs used in the analysis bound the WBN Unit 2 D3 SGs. As shown in Table 1, WBN Unit 2 has an RCS temperature uncertainty of one degree Fahrenheit (1°F) greater than WBN Unit 1. However, a calculation performed by Westinghouse determined that the increased RCS metal energy and RCS fluid energy due to the additional 1°F RCS temperature uncertainty in WBN Unit 2 is more than offset by the metal energy associated with the larger tube mass in the WBN Unit 1 RSGs as compared to the WBN Unit 2 D3 SGs, as shown in Table 1. Otherwise, the nuclear steam supply system (NSSS) operating parameters are either the same between WBN Unit 1 and WBN Unit 2, or the WBN Unit 1 values bound WBN Unit 2.

3.4.4.2 Containment Integrity

Table 2 provides a summary of the containment integrity evaluation input comparison. The WBN Unit 1 and Unit 2 LOTIC1 containment models are identical. The containment volume, containment initial conditions, structural heat sinks, containment air recirculation, hydrogen skimmer system, and containment heat removal inputs for the WBN Unit 2 D3 SG conditions are the same as the WBN Unit 1 RSG values.

3.4.5 Conclusions

As shown above, the WBN Unit 1 WCOBRA/TRAC LOCA M&E analysis bounds WBN Unit 2 with D3 SG conditions. Also, the WBN Unit 1 and WBN Unit 2 LOTIC1 containment models are identical. TVA has determined that the results and conclusions of the WBN Unit 1 WCOBRA/TRAC LOCA M&E and containment integrity analyses documented in Reference 4 are applicable to WBN Unit 2. Therefore, this evaluation supports a revised WBN Unit 2 ice mass limit identical to the WBN Unit 1 ice mass limit.

Table 1 WBN Unit 1 RSG and WBN Unit 2 D3 SG LOCA M&E Input Comparison		
Parameters	**WBN Unit 1 RSG Value**	**WBN Unit 2 D3 SG Value**
NSSS Operating Parameters		
Core thermal power (MWt)	3,479.75[1]	3,479.75[2]
Reactor coolant system (RCS) flow rate (gpm/loop)	93,100	93,100
RCS pressure (psia)	2,250	2,250
RCS pressure uncertainty (psi)	70	27.2
Reactor vessel average temperature (°F)	588.2	588.2
RCS temperature uncertainty (°F)	6	7
SG outlet pressure (psia)	1,090	1,034
Trip Setpoints		
Low pressurizer pressure reactor trip (psia)	1,984.7	1,984.7
Low pressurizer pressure safety injection setpoint (seconds)	1,884.7	1,884.7
SI signal delay (seconds)	32	32
Accumulator Parameters		
Water volume (ft^3)	1,005	1,005
Nitrogen (N_2) pressure (psia)	704.7	704.7
Temperature (°F)	130	130
Pressurizer Parameters		
Pressurizer level	60% span	60% span
Pressurizer level uncertainty	8%	6.6%
Safety Injection Flows		
Charging pump injection flow (gpm) including DG frequency reduction	356.0	357.7
Intermediate head pump injection flow (gpm) including DG uncertainty	559.8	559.9
Low head pump injection flow (gpm) including DG uncertainty	3,671.1	3,687.8

Table 1
WBN Unit 1 RSG and WBN Unit 2 D3 SG
LOCA M&E Input Comparison

Parameters	**WBN Unit 1 RSG Value**	**WBN Unit 2 D3 SG Value**
Total injection flow (gpm)	4,586.9	4,605.4
Recirculation Flows		
Charging pump recirculation flow (gpm) including DG uncertainty	363.8	340.9
Intermediate head pump recirculation flow (gpm) including DG uncertainty	591.6	535.8
Low head pump recirculation flow (gpm) including DG uncertainty	2,244.9	2,286.6
Total recirculation flow (gpm)	3,200.3	3,163.3
Fuel temperatures	The fuel temperatures used in the WBN Unit 1 analysis of record are based on PAD4+TCD (i.e., fuel thermal conductivity degradation was accounted for), and were calculated at a conservative burnup to maximize core stored energy. This method is consistent with NRC Condition 1 in the WCAP-17721-P safety evaluation (Reference 5). Because WBN Unit 1 and WBN Unit 2 share the same fuel design, the WBN Unit 1 fuel modeling, with respect to fuel temperatures, bounds WBN Unit 2.	
SG design	68AXP	D3
SG dry mass (lbm)	760,187	704,500
Heat transfer area (ft^3)	68,000	48,000
SG secondary side water mass (lbm) including 10% conservatism	139,162	122,474

Notes:

1. The current WBN Unit 1 maximum core thermal power operating limit is 3459 MWt. The containment analysis has been conservatively performed at a core thermal power of 3479.75 MWt, which is approximately 101% of the 3459 MWt operating limit.

2. The current WBN Unit 2 maximum core thermal power operating limit is 3411 MWt. The containment analysis has been conservatively performed at a core thermal power of 3479.75 MWt, which is approximately 102% of the 3411 MWt operating limit.

Table 2 WBN Unit 1 RSG and WBN Unit 2 D3 SG Containment Integrity Input Comparison		
Parameters	**WBN Unit 1 RSG Value**	**WBN Unit 2 D3 SG Value**
Containment Volume		
Upper compartment volume (ft^3)	645,818	645,818
Lower compartment volume (ft^3)	221,074	221,074
Ice condenser volume (ft^3)	183,811	183,811
Dead ended compartment volume (ft^3)	146,600	146,600
Active sump volume (ft^3)	51,000	51,000
Containment Initial Conditions		
Ice bed temperature (°F)	27.0	27.0
Range of upper compartment air temperature (°F)	85-110	85-110
Range of lower compartment air temperature (°F)	100-120	100-120
Relative humidity for non-ice-compartments (%)	10	10
Structural Heat Sinks		
Structural heat sink data	The heat sinks and material properties for the WBN Unit 1 and WBN Unit 2 LOTIC1 models are the same	
Structural material property data		
Containment Air Recirculation / Hydrogen Skimmer System		
Upper compartment return (cfm)	40,000	40,000
Containment air return fan delay time (seconds)	600	600
Containment Heat Removal		
Emergency raw cooling water (ERCW) flow to CCS heat exchanger, single train (gpm)	3,500	3,500
CCW flow to residual heat removal (RHR) heat exchanger (gpm)	5,000	5,000
Containment spray (CS) flow rate, single train, upper compartment, injection and recirculation (gpm)	4,000	4,000
RHR spray flow rate, single train (gpm)	1,462.3	1,462.3

Table 2
WBN Unit 1 RSG and WBN Unit 2 D3 SG Containment Integrity Input Comparison

Parameters	WBN Unit 1 RSG Value	WBN Unit 2 D3 SG Value
ERCW flow to the CS heat exchanger, single train (gpm)	5,200	5,200
Containment Heat Removal (continued)		
RHR heat exchanger coefficient (MBTU/hr-°F)	1.496	1.496
CS heat exchanger coefficient (MBTU/hr-°F)	2.44	2.44
CCS heat exchanger coefficient (MBTU/hr-°F)	3.17	3.17
Ultimate heat sink temperature (°F)	88	88
RHR containment spray actuation time (seconds)	3,600 seconds if containment pressure is > 9.5 psig	3,600 seconds if containment pressure is > 9.5 psig
CS delay time (seconds)	234	234
Maximum refueling water storage tank temperature (°F)	105	105

4.0 REGULATORY EVALUATION

4.1 APPLICABLE REGULATORY REQUIREMENTS/CRITERIA

4.1.1 Regulations

10 CFR 50.36 sets forth the regulatory requirements for the content of the TSs. This regulation requires, in part, that the TS contain SRs. 10 CFR 50.36(c)(3), states that SRs to be included in the TS are those relating to test, calibration, or inspection which assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the TS LCO will be met.

4.1.2 General Design Criteria

As noted in the WBN dual-unit UFSAR Section 3.1.1, WBN was designed to meet the intent of the "Proposed General Design Criteria for Nuclear Power Plant Construction Permits" published in July 1967. The WBN construction permit was issued in January 1973. The WBN Unit 2 UFSAR, however, addresses the NRC General Design Criteria (GDC) published as Appendix A to 10 CFR 50 in July 1971, including Criterion 4 as amended October 27, 1987.

The WBN UFSAR contains these GDC followed by a discussion of the design features and procedures that meet the intent of the criteria. The relevant GDC are described below.

Criterion 16 - Containment Design

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

Conformance with GDC 16 is described in Section 3.1.2.2 of the WBN dual-unit UFSAR.

Criterion 38 - Containment Heat Removal

A system to remove heat from the reactor containment shall be provided. The system safety function shall be to reduce rapidly, consistent with the functioning of other associated systems, the containment pressure and temperature following any LOCA and maintain them at acceptably low levels.

Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

Conformance with GDC 38 is described in Section 3.1.2.4 of the WBN dual-unit UFSAR.

Criterion 39 - Inspection of Containment Heat Removal System

The containment heat removal system shall be designed to permit appropriate periodic inspection of important components, such as the torus, pumps, spray nozzles, and piping to assure the integrity and capability of the system.

Conformance with GDC 39 is described in Section 3.1.2.4 of the WBN dual-unit UFSAR.

Criterion 40 - Testing of Containment Heat Removal System

The containment heat removal system shall be designed to permit appropriate periodic pressure and functional testing to assure (1) the structural and leaktight integrity of its components, (2) the operability and performance of the active components of the system, and (3) the operability of the system as a whole, and, under conditions as close to the design as practical, the performance of the full operational sequence that brings the system into operation, including operation of applicable portions of the protection system, the transfer between normal and emergency power sources, and the operation of the associated cooling water system.

Conformance with GDC 40 is described in Section 3.1.2.4 of the WBN dual-unit UFSAR.

Criterion 50 - Containment Design Basis

The reactor containment structure, including access openings, penetrations, and the containment heat removal system shall be designed so that the containment structure and its internal compartments can accommodate, without exceeding the design leakage rate and, with sufficient margin, the calculated pressure and temperature conditions resulting from any LOCA.

This margin shall reflect consideration of (1) the effects of potential energy sources which have not been included in the determination of the peak conditions, such as energy in steam generators and energy from metal-water and other chemical reactions that may result from degraded emergency core cooling functioning, (2) the limited experience and experimental data available for defining accident phenomena and containment responses, and (3) the conservatism of the calculational model and input parameters.

Conformance with GDC 50 is described in Section 3.1.2.5 of the WBN dual-unit UFSAR.

There will be no changes to the WBN design such that compliance with any of the regulatory requirements above would come into question. As such, WBN Unit 2 will continue to comply with the applicable regulatory requirements.

4.2 PRECEDENTS

The following precedents are related to the proposed TS change in this submittal:

1. Watts Bar Nuclear Plant, Unit 1, Docket No. 50-390, License No. NPF-90, License Amendment No. 33, dated November 29, 2001. The NRC approved a reduction in the minimum average ice basket weight from 1,236 lb to 1,110 lb and the overall weight of ice required in the ice condenser from 2,403,800 lb to 2,158,000 lb (ML013330646).
2. Sequoyah Nuclear Plant, Units 1 and 2, Docket Nos. 50-327 and 50-328, License Nos. DPR-77 and DPR-79, License Amendment Nos. 224 and 215, respectively, dated June 10, 1997. The NRC approved a reduction in the overall weight of ice required in the ice condenser from 2,245,320 lb to 2,082,024 lb (ML013320424).
3. Watts Bar Nuclear Plant, Unit 1, Docket No. 50-390, License No. NPF-90, License Amendment No. 62, dated July 25, 2006. The NRC approved an increase in the minimum required average ice basket weight from 1,110 lb to 1237 lb, and the corresponding total weight of the stored ice in the ice condenser from 2,158,000 lb to 2,404,500 lb based on the RSGs (ML061830005).

4.3 SIGNIFICANT HAZARDS CONSIDERATION

The Tennessee Valley Authority (TVA) is proposing an amendment to revise the Watts Bar Nuclear Plant (WBN) Unit 2 Technical Specifications (TS) to revise the WBN Unit 2 ice mass limits in TS Surveillance Requirements (SRs) 3.6.11.2 and 3.6.11.3 to be identical to the ice mass limits in the WBN Unit 1 TS SRs 3.6.11.2 and 3.6.11.3. Specifically, the proposed change revises the ice mass limits in TS SRs 3.6.11.2 and 3.6.11.3 to reduce the total weight of stored ice from greater than or equal to (≥) 2,750,700 pounds (lb) to ≥2,404,500 lb and the ice limit of each basket and the average ice weight of the sample baskets from ≥1,415 lb to ≥1,237 lb.

As part of the TVA effort to align the WBN Unit 1 and Unit 2 loss of coolant accident (LOCA) mass and energy (M&E) methodology, the current ice mass limits for WBN Unit 2 have been evaluated with respect to the limits supported by the current WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology. In order to determine if the WBN Unit 1 LOCA M&E and containment integrity analyses can be applied to WBN Unit 2, TVA performed a detailed comparison of the WBN Unit 2 primary system design, operating parameters, reactor protection features, emergency core cooling system (ECCS) capabilities, fuel design, containment design and analytical inputs to those modeled in the WBN Unit 1 analyses

The WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology is conservative, in comparison to WBN Unit 2, because it is modeled on the WBN Unit 1 replacement steam generators (RSGs) (Model 68AXP), which have a greater mass, volume, and stored metal energy than the WBN Unit 2 original model D3 SGs. The proposed change to the WBN Unit 2 ice mass limits in SRs 3.6.11.2 and 3.6.11.3 will achieve greater efficiency in the alignment of maintenance and surveillance activities for both units during refueling outages.

TVA has evaluated whether or not a significant hazards consideration is involved with the proposed amendment(s) 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?

   Response: No.

   The primary purpose of the ice bed is to provide a large heat sink to limit peak containment pressure in the event of a release of energy from a design basis LOCA or high energy line break (HELB) in containment. The LOCA requires the greatest amount of ice compared to other accident scenarios; therefore, the reduction in ice weight is based on the LOCA analysis. The amount of ice in the bed has no impact on the initiation of an accident, but rather on the mitigation of the accident. The containment integrity analysis shows that the proposed reduced ice weight is sufficient to maintain the peak containment pressure below the containment design pressure, and that the containment heat removal systems function to rapidly reduce the containment pressure and temperature in the event of a LOCA. Therefore, containment integrity is maintained and the consequences of an accident previously evaluated in the WBN dual-unit Updated Final Safety Analysis Report (UFSAR) are not 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.

   The ice condenser serves to limit the peak pressure inside containment following a LOCA. TVA has evaluated the revised containment pressure analysis and determined that sufficient ice would be present to maintain the peak containment pressure below the containment design pressure. Therefore, the reduced ice weight does not create the possibility of an accident that is different than any already evaluated in the WBN dual-unit UFSAR. No new accident scenarios, failure mechanisms, or limiting single failures are introduced as a result of this proposed change.

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

   Response: No.

   The proposed TS ice weight SR limit is based on the conservatism of the WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology in comparison to the WBN Unit 2 operating conditions. The WBN Unit 1 WCOBRA/TRAC LOCA M&E methodology is modeled on the WBN Unit 1 RSGs, which have a greater mass, volume, and stored metal energy than the WBN Unit 2 original model D3 SGs. Additionally, the containment pressure calculations in Section 6.2.1.3.3 of the WBN Unit 1 portion of the WBN dual-unit UFSAR state that the analytical limit for the mass of ice assumed in the WBN Unit 1 ice condenser, in order to limit the maximum containment peak pressure from a LOCA to below the containment design pressure, is 2,260,000 lb. The proposed revised TS SR ice mass limit of 2,404,500 lb includes additional ice mass to conservatively bound ice bed sublimation effects. Based on TVA's evaluation and the revised containment analysis, TVA considers the reduction of the ice mass limit to be acceptable for satisfying the safety function of the ice condenser for the current SR interval. Therefore, the proposed change does not involve a significant reduction in the margin of safety.

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

4.4 CONCLUSIONS

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

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or SR. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released 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. TVA letter to NRC, CNL-16-159, “Application to Modify Watts Bar Nuclear Plant Unit 2 Technical Specifications to Extend Surveillance Requirement (SR) Intervals for SRs 3.6.11.2 and 3.6.11.3 (WBN-TS-16-022),” dated September 30, 2016 (ML16277A477)
2. NRC letter to TVA, “Watts Bar Nuclear Plant, Unit 1 — Issuance of Amendment Regarding Technical Specification Change to Increase Containment Ice Condenser Ice Weight to Support Replacement Steam Generators (TAC No. MC9270),” dated July 25, 2006 (ML061830005)
3. NRC Letter to Westinghouse Electric Company, “Acceptance for Referencing of Licensing Topical Report WCAP-10325, ‘Westinghouse LOCA Mass and Energy Release Model for Containment Design Proprietary - March 1979 Version’,” dated February 17, 1987 (8702200098)
4. TVA letter to NRC, CNL-15-126, “Notification of Revised Westinghouse Containment Integrity Analysis,” dated September 11, 2015 (ML15254A564)
5. NRC Letter to Westinghouse Electric Company, “Final Safety Evaluation for Westinghouse Electric Company (Westinghouse) Topical Report (TR) WCAP-17721-P, Revision 0, and WCAP-17721-NP, Revision 0, ‘Westinghouse Containment Analysis Methodology – PWR [Pressurized Water Reactor] LOCA [Loss-of-Coolant Accident] Mass and Energy Release Calculation Methodology’,” dated August 24, 2015 (ML15221A005)
6. WCAP-8354-P-A, Revision 0 (Proprietary) and WCAP-8355-A, Revision 0 (Non-Proprietary), “Long Term Ice Condenser Containment Code – LOTIC Code,” April 1976.

Enclosure

Evaluation of Proposed Technical Specification Change

Attachment 1

Proposed TS Changes (Mark-Ups) for WBN Unit 2

3.0 SR APPLICABILITY (continued)

Table SR 3.0.2-1		
Surveillance Requirement (SR)	Description of SR Requirement	Frequency Extension Limit
3.6.11.2	Verify total weight of stored ice is greater than or equal to ~~2,750,700~~2,404,500 lb by: a. Weighing a representative sample of ≥ 144 ice baskets and verifying each basket contains greater than or equal to ~~1415~~1237 lb of ice; and b. Calculating total weight of stored ice, at a 95 percent confidence level, using all ice basket weights determined in SR 3.6.11.2.a.	10/31/17
3.6.11.3	Verify azimuthal distribution of ice at a 95 percent confidence level by subdividing weights, as determined by SR 3.6.11.2.a, into the following groups: a. Group 1-bays 1 through 8; b. Group 2-bays 9 through 16; and c. Group 3-bays 17 through 24. The average ice weight of the sample baskets in each group from radial rows 1, 2, 4, 6, 8, and 9 shall be greater than or equal to ~~1415~~1237 lb.	10/31/17

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.11.2	Verify total weight of stored ice is greater than or equal to ~~2,750,700~~2,404,500 lb by: a. Weighing a representative sample of ≥ 144 ice baskets and verifying each basket contains greater than or equal to ~~1415~~1237 lb of ice; and b. Calculating total weight of stored ice, at a 95 percent confidence level, using all ice basket weights determined in SR 3.6.11.2.a.	18 months
SR 3.6.11.3	Verify azimuthal distribution of ice at a 95 percent confidence level by subdividing weights, as determined by SR 3.6.11.2.a, into the following groups: a. Group 1-bays 1 through 8; b. Group 2-bays 9 through 16; and c. Group 3-bays 17 through 24. The average ice weight of the sample baskets in each group from radial rows 1, 2, 4, 6, 8, and 9 shall be greater than or equal to ~~1415~~1237 lb.	18 months
SR 3.6.11.4	Verify, by visual inspection, accumulation of ice on structural members comprising flow channels through the ice bed is less than or equal to 15 percent blockage of the total flow area for each safety analysis section.	18 months

(continued)

Enclosure

Evaluation of Proposed Technical Specification Change

Attachment 2

Proposed TS Bases Changes (Mark-Ups) for WBN Unit 2 (For Information Only)

B 3.6 CONTAINMENT SYSTEMS

B 3.6.11 Ice Bed

BASES

BACKGROUND

The ice bed consists of over ~~2,750,700~~2,404,500 lbs of ice stored in 1944 baskets within the ice condenser. Its primary purpose is to provide a large heat sink in the event of a release of energy from a Design Basis Accident (DBA) in containment. The ice would absorb energy and limit containment peak pressure and temperature during the accident transient. Limiting the pressure and temperature reduces the release of fission product radioactivity from containment to the environment in the event of a DBA.

The ice condenser is an annular compartment enclosing approximately 300° of the perimeter of the upper containment compartment, but penetrating the operating deck so that a portion extends into the lower containment compartment. The lower portion has a series of hinged doors exposed to the atmosphere of the lower containment compartment, which, for normal plant operation, are designed to remain closed. At the top of the ice condenser is another set of doors exposed to the atmosphere of the upper compartment, which also remain closed during normal plant operation. Intermediate deck doors, located below the top deck doors, form the floor of a plenum at the upper part of the ice condenser. These doors also remain closed during normal plant operation. The upper plenum area is used to facilitate surveillance and maintenance of the ice bed.

The ice baskets contain the ice within the ice condenser. The ice bed is considered to consist of the total volume from the bottom elevation of the ice baskets to the top elevation of the ice baskets. The ice baskets position the ice within the ice bed in an arrangement to promote heat transfer from steam to ice. This arrangement enhances the ice condenser's primary function of condensing steam and absorbing heat energy released to the containment during a DBA.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.11.2

The weighing program is designed to obtain a representative sample of the ice baskets. The representative sample shall include 6 baskets from each of the 24 ice condenser bays and shall consist of one basket from radial rows 1, 2, 4, 6, 8, and 9. If no basket from a designated row can be obtained for weighing, a basket from the same row of an adjacent bay shall be weighed.

The rows chosen include the rows nearest the inside and outside walls of the ice condenser (rows 1 and 2, and 8 and 9, respectively), where heat transfer into the ice condenser is most likely to influence melting or sublimation. Verifying the total weight of ice ensures that there is adequate ice to absorb the required amount of energy to mitigate the DBAs.

If a basket is found to contain less than ~~1415~~1237 lb of ice, a representative sample of 20 additional baskets from the same bay shall be weighed. The average weight of ice in these 21 baskets (the discrepant basket and the 20 additional baskets) shall be greater than or equal to ~~1415~~1237 lb at a 95% confidence level. [Value does not account for instrument error.]

Weighing 20 additional baskets from the same bay in the event a Surveillance reveals that a single basket contains less than ~~1415~~1237 lb ensures that no local zone exists that is grossly deficient in ice. Such a zone could experience early melt out during a DBA transient, creating a path for steam to pass through the ice bed without being condensed. The Frequency of 18 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. Operating experience has verified that, with the 18 month Frequency, the weight requirements are maintained with no significant degradation between surveillances.

SR 3.6.11.3

This SR ensures that the azimuthal distribution of ice is reasonably uniform, by verifying that the average ice weight in each of three azimuthal groups of ice condenser bays is within the limit. The Frequency of 18 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. Operating experience has verified that, with the 18-month Frequency, the weight requirements are maintained with no significant degradation between surveillances.

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Enclosure

Evaluation of Proposed Technical Specification Change

Attachment 3

Proposed TS Changes (Final Typed) for WBN Unit 2

3.0 SR APPLICABILITY (continued)

Table SR 3.0.2-1		
Surveillance Requirement (SR)	Description of SR Requirement	Frequency Extension Limit
3.6.11.2	Verify total weight of stored ice is greater than or equal to 2,404,500 lb by: a. Weighing a representative sample of ≥ 144 ice baskets and verifying each basket contains greater than or equal to 1237 lb of ice; and b. Calculating total weight of stored ice, at a 95 percent confidence level, using all ice basket weights determined in SR 3.6.11.2.a.	10/31/17
3.6.11.3	Verify azimuthal distribution of ice at a 95 percent confidence level by subdividing weights, as determined by SR 3.6.11.2.a, into the following groups: a. Group 1-bays 1 through 8; b. Group 2-bays 9 through 16; and c. Group 3-bays 17 through 24. The average ice weight of the sample baskets in each group from radial rows 1, 2, 4, 6, 8, and 9 shall be greater than or equal to 1237 lb.	10/31/17

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.11.2	Verify total weight of stored ice is greater than or equal to 2,404,500 lb by: a. Weighing a representative sample of ≥ 144 ice baskets and verifying each basket contains greater than or equal to 1237 lb of ice; and b. Calculating total weight of stored ice, at a 95 percent confidence level, using all ice basket weights determined in SR 3.6.11.2.a.	18 months
SR 3.6.11.3	Verify azimuthal distribution of ice at a 95 percent confidence level by subdividing weights, as determined by SR 3.6.11.2.a, into the following groups: a. Group 1-bays 1 through 8; b. Group 2-bays 9 through 16; and c. Group 3-bays 17 through 24. The average ice weight of the sample baskets in each group from radial rows 1, 2, 4, 6, 8, and 9 shall be greater than or equal to 1237 lb.	18 months
SR 3.6.11.4	Verify, by visual inspection, accumulation of ice on structural members comprising flow channels through the ice bed is less than or equal to 15 percent blockage of the total flow area for each safety analysis section.	18 months

(continued)

Enclosure

Evaluation of Proposed Technical Specification Change

Attachment 4

Proposed TS Bases Changes (Final Typed) for WBN Unit 2 (For Information Only)

B 3.6 CONTAINMENT SYSTEMS

B 3.6.11 Ice Bed

BASES

BACKGROUND

The ice bed consists of over 2,404,500 lbs of ice stored in 1944 baskets within the ice condenser. Its primary purpose is to provide a large heat sink in the event of a release of energy from a Design Basis Accident (DBA) in containment. The ice would absorb energy and limit containment peak pressure and temperature during the accident transient. Limiting the pressure and temperature reduces the release of fission product radioactivity from containment to the environment in the event of a DBA.

The ice condenser is an annular compartment enclosing approximately 300° of the perimeter of the upper containment compartment, but penetrating the operating deck so that a portion extends into the lower containment compartment. The lower portion has a series of hinged doors exposed to the atmosphere of the lower containment compartment, which, for normal plant operation, are designed to remain closed. At the top of the ice condenser is another set of doors exposed to the atmosphere of the upper compartment, which also remain closed during normal plant operation. Intermediate deck doors, located below the top deck doors, form the floor of a plenum at the upper part of the ice condenser. These doors also remain closed during normal plant operation. The upper plenum area is used to facilitate surveillance and maintenance of the ice bed.

The ice baskets contain the ice within the ice condenser. The ice bed is considered to consist of the total volume from the bottom elevation of the ice baskets to the top elevation of the ice baskets. The ice baskets position the ice within the ice bed in an arrangement to promote heat transfer from steam to ice. This arrangement enhances the ice condenser's primary function of condensing steam and absorbing heat energy released to the containment during a DBA.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.11.2

The weighing program is designed to obtain a representative sample of the ice baskets. The representative sample shall include 6 baskets from each of the 24 ice condenser bays and shall consist of one basket from radial rows 1, 2, 4, 6, 8, and 9. If no basket from a designated row can be obtained for weighing, a basket from the same row of an adjacent bay shall be weighed.

The rows chosen include the rows nearest the inside and outside walls of the ice condenser (rows 1 and 2, and 8 and 9, respectively), where heat transfer into the ice condenser is most likely to influence melting or sublimation. Verifying the total weight of ice ensures that there is adequate ice to absorb the required amount of energy to mitigate the DBAs.

If a basket is found to contain less than 1237 lb of ice, a representative sample of 20 additional baskets from the same bay shall be weighed. The average weight of ice in these 21 baskets (the discrepant basket and the 20 additional baskets) shall be greater than or equal to 1237 lb at a 95% confidence level. [Value does not account for instrument error.]

Weighing 20 additional baskets from the same bay in the event a Surveillance reveals that a single basket contains less than 1237 lb ensures that no local zone exists that is grossly deficient in ice. Such a zone could experience early melt out during a DBA transient, creating a path for steam to pass through the ice bed without being condensed. The Frequency of 18 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. Operating experience has verified that, with the 18 month Frequency, the weight requirements are maintained with no significant degradation between surveillances.

SR 3.6.11.3

This SR ensures that the azimuthal distribution of ice is reasonably uniform, by verifying that the average ice weight in each of three azimuthal groups of ice condenser bays is within the limit. The Frequency of 18 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. Operating experience has verified that, with the 18-month Frequency, the weight requirements are maintained with no significant degradation between surveillances.

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