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

June 12, 2015

CNL-15-078

10 CFR 50.90

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

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NPF-90
NRC Docket No. 50-390

Subject: **Response to NRC Request for Additional Information Related to Application to Modify Watts Bar Nuclear Plant, Unit 1 Technical Specifications Regarding AC Sources - Operating (TS-WBN-13-02) (TAC No. MF2549)**

References:

1. Letter from TVA to NRC, "Application to Modify Watts Bar Nuclear Plant, Unit 1 Technical Specifications Regarding AC Sources - Operating (TS WBN-13-02)," dated August 1, 2013 [ML13220A103]

2. Email from Andrew Hon (NRC) to Joseph W. Shea (TVA), "Watts Bar Nuclear Plant, Unit 1 - Request For Additional Information Regarding Application to Modify Technical Specifications Related To AC Sources - Operating (TAC No. MF2549)," dated February 26, 2014 [ML14056A525]

3. Letter from TVA to NRC, "Response to NRC Request for Additional Information Related to Application to Modify Watts Bar Nuclear Plant, Unit 1 Technical Specifications Related to AC Sources - Operating (TS WBN-13-02)," dated April 21, 2014 [ML14112A341]

4. Email from Jeanne Dion (NRC) to Gordon Arent (TVA), "RAI 1 for CSST LAR," dated June 2, 2014 (TAC No. MF2549) [ML14168A613]

5. Letter from TVA to NRC, "Response to NRC Request for Additional Information Related to Application to Modify Watts Bar Nuclear Plant, Unit 1 Technical Specifications Regarding AC Sources - Operating (TS WBN-13-02)," dated January 29, 2015 [ML15041A732]

6. Email from Anthony Minarik (NRC) to Gordon Arent (TVA), "Final RAIs MF2549 WBN, U1 CSST License Amendment Request," dated April 15, 2015 [ML15105A525]

By letter dated August 1, 2013 (Reference 1), Tennessee Valley Authority (TVA) submitted a license amendment request (LAR) for Watts Bar Nuclear Plant (WBN) Unit 1. The purpose of the LAR was to modify limiting conditions for operation for Technical Specification (TS) 3.8.1, "AC Sources - Operating," Surveillance Requirement 3.8.1.8, and the current licensing basis, as described in the Updated Final Safety Analysis Report, for the available maintenance feeder for Common Station Service Transformers (CSSTs) A and B.

On February 26, 2014, the Nuclear Regulatory Commission (NRC) transmitted a request for additional information (RAI) by electronic mail (email) (Reference 2). TVA responded to the Reference 2 RAI by letter dated April 21, 2014 (Reference 3). On April 24, 2014, the NRC conducted a public meeting where TVA responses provided in Reference 3 were discussed.

Subsequently, on June 2, 2014, the NRC transmitted an additional RAI (Reference 4). This RAI requested further explanation of the information provided in the Reference 3 response, as discussed during the public meeting held on April 24, 2014.

By letter dated January 29, 2015 (Reference 5), TVA submitted a response to the Reference 4 RAIs, revising the LAR for WBN Unit 1. The revised LAR would allow TVA to use CSSTs A and B as offsite power sources for an indefinite time in lieu of CSST C or D.

On April 15, 2015, the NRC transmitted RAIs by email to TVA (Reference 6). On April 30, 2015, the NRC conducted a public meeting where TVA preliminary responses to the Reference 6 RAIs were discussed. The enclosure to this letter provides the TVA response to the Reference 6 RAIs, as discussed during the public meeting held on April 30, 2015.

Consistent with the standards set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.92(c), TVA has determined that the response, as provided in this letter, does not affect the no significant hazards considerations associated with the proposed license amendment previously provided in Reference 1. TVA has further determined that the proposed amendment still 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 the enclosure to the Tennessee Department of Environment and Conservation.

There are no new regulatory commitments included in this submittal. Please address any questions regarding this submittal to Gordon Arent at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 12th day of June 2015.

Respectfully,

J. W. Shea

Digitally signed by J. W. Shea
DN: cn=J. W. Shea, o=Tennessee Valley Authority, ou=Nuclear Licensing, email=jwshea@tva.gov, c=US
Date: 2015.06.12 13:49:05 -04'00'

J. W. Shea
Vice President, Nuclear Licensing

Enclosure:

Response to Request for Additional Information, Offsite Power Availability Requirements

cc (w Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant, Unit 1
NRC Project Manager - Watts Bar Nuclear Plant, Unit 1
Director - Division of Radiological Health – Tennessee State Department of Environment and Conservation

ENCLOSURE
Watts Bar Nuclear Plant, Unit 1
Response to Request for Additional Information,
Offsite Power Availability Requirements

**NRC'S Request For Additional Information (RAI)**

The following questions were developed as a result of the staff's review of the licensee's revised license amendment request (LAR) submitted by letter dated January 29, 2015. The revised LAR proposes to change Technical Specification (TS) Surveillance Requirement (SR) 3.8.1.8 and modify the current licensing basis as described in the Updated Final Safety Analysis Report (UFSAR). This would allow the licensee to use Common Station Service Transformers (CSSTs) A and B as offsite power source for an indefinite time in lieu of CSST C or D.

1. *The current licensing basis of the plant has the offsite power sources with the capability to power each of the Shutdown Boards 1A-A and 1B-B from CSSTs C and D. For compliance with General Design Criterion [GDC] 17, each shutdown board has an immediately available normal source, CSST C for 1A-A and CSST D for 1B-B and an automatic transfer to the alternate source CSST D for 1A-A and CSST C for 1B-B. CSSTs A or B, when used as offsite power circuits for extended duration, do not have similar flexibility or capability. 10 CFR 50.36 requires* Limiting conditions for operation (LCO) to be specified when *remedial actions are permitted by the TS to restore the plant to full compliance. In view of the reduction in defense in depth from the current TS (i.e., when CSST A or B is used as a GDC 17 power source), please provide details on proposed duration (LCO) when using the maintenance feeds through CSSTs A or B in lieu of CSSTs C or D.*

2. *In case of a loss of offsite power (LOOP) event, the onsite power sources are required to connect to the safety busses. In order to recover from a LOOP or a station blackout (SBO) event, the offsite power sources have to be restored to the safety busses. The current TS surveillances validate the capability to parallel the onsite and offsite sources for successful transfer between the two sources through CSSTs C and D. To demonstrate operability of a power source, the licensee has to perform periodic surveillances in their required power source alignment to comply with the requirements of 10 CFR 50.36. The current TS proposal to use CSST A or B as GDC 17 sources does not appear to have TS surveillances to validate a similar capability. Please provide information on surveillances that will be performed to demonstrate the operability of the circuits between the switchyard and the safety busses through CSST A or B.*

3. *Please confirm that the components in the circuits associated with CSSTs A and B, 161 kV switchyard and the safety busses will be subjected to the requirements of the Maintenance Rule as applicable under 10 CFR 50.65 "Requirements for monitoring the effectiveness of maintenance at nuclear power plants."*

4. *Assuming that CSST A or B is being used as an offsite power source for the safety [boards] with both [Watts Bar Nuclear Plant] WBN units operating at full power, the sequence of events following an accident signal in one unit could be reactor trip, turbine trip and a delayed generator trip depending on the coast down time of the generator. The safety buses will have accident loads block loaded while the generator in coast down. After the generator trip, the safety busses will be transferred to the CSST A or [B] depending on the selected source. Please provide the following information.*

    i. *A summary of analyses performed to demonstrate the consequences of this sequence of events on the accident analyses.*

ii. *Details or referenced information in the licensing basis documenting the adequacy of this design as related to accident analyses.*

iii. *Summary of electrical system analyses performed with the grid at minimum allowable voltage and simultaneous restart or reacceleration of all safety related and non-safety related loads, assuming a design basis accident in one unit and simultaneous orderly shutdown of the other unit.*

5. Since the operation of non-safety related circuit breakers related with offsite power sources is critical for separation and restoration of power from the switchyard, plant designs incorporate redundant trip coils and closing coils powered from reliable [direct current] (DC) sources. Please confirm if the circuit breakers associated with CSSTs A and B and offsite power source have similar design features.

**Tennessee Valley Authority (TVA) Response**

**NRC RAI No. 1**

*The current licensing basis of the plant has the offsite power sources with the capability to power each of the Shutdown Boards 1A-A and 1B-B from CSSTs C and D. For compliance with General Design Criterion 17, each shutdown board has an immediately available normal source, CSST C for 1A-A and CSST D for 1B-B and an automatic transfer to the alternate source CSST D for 1A-A and CSST C for 1B-B. CSSTs A or B, when used as offsite power circuits for extended duration, do not have similar flexibility or capability. 10 CFR 50.36 requires* Limiting conditions for operation (LCO) to be specified when *remedial actions are permitted by the TS to restore the plant to full compliance. In view of the reduction in defense in depth from the current TS (i.e., when CSST A or B is used as a GDC 17 power source), please provide details on proposed duration (LCO) when using the maintenance feeds through CSSTs A or B in lieu of CSSTs C or D.*

**TVA Response**

In NRC RAI No. 1 (above), the RAI makes the following statement.

*"For compliance with General Design Criterion 17, each shutdown board has an immediately available normal source, CSST C for 1A-A and CSST D for 1B-B and an automatic transfer to the alternate source CSST D for 1A-A and CSST C for 1B-B."*

TVA disagrees that the underlined portion of this statement is required to meet 10 CFR 50, Appendix A, GDC 17, under all 6.9 kV shutdown board alignments. The automatic and manual transfer feature of the 6.9 kV shutdown boards from the normal source to the alternate source allows operational flexibility in WBN Unit 1 Technical Specification for source alignment other than to their normal source. TVA's basis for this position is discussed below.

To meet GDC 17, WBN uses two immediate access 161 kV circuits providing offsite power through two power circuit breakers connecting with separate sections of the main bus in the Watts Bar Hydro Plant (WBH) switchyard. The two overhead transmission lines are routed to minimize the probability of their simultaneous failure. Each 161 kV line terminates at a pair of 161 - 6.9 kV CSSTs (A and D, and B and C, respectively). Each pair of transformers, as well as

the buses and cables that are used to connect them to the onsite power (standby) distribution system at the 6.9 kV shutdown boards are physically and electrically independent. The CSSTs and buses are connected and arranged to provide two physically independent offsite power circuits to the onsite (Class 1E) distribution system. One offsite power circuit that is connected to CSSTs A and D is designated P (Figure 1 blue lines) while the other offsite power circuit that is connected to CSSTs B and C is designated R (Figure 1 red lines). Circuits designated P and R are routed in separate conduits and trays to assure physical independence.

Each of the four 6.9 kV shutdown boards normal and alternate connection to the offsite power circuits is via CSST C or D through the 6.9 kV shutdown boards normal or alternate supply breakers. Each of the four 6.9 kV shutdown boards maintenance connection to the offsite power circuits is via CSST A or B through the 6.9 kV shutdown boards maintenance supply breakers.

Transfers from the normal source to the alternate source may be manual or automatic. Transfers from the alternate source to the normal source are manual only. Transfers to or from the maintenance source are manual only. Automatic transfers from the normal power source to the alternate power source are initiated by any transformer or line failure relays. For a loss of power from either CSST C or D not due to a fault in the CSST, or loss of power from either CSST A or B, the affected 6.9 kV shutdown board loads will be disconnected from offsite power and sequentially loaded onto their respective diesel generator (DG).

When all 6.9 kV shutdown boards are aligned to their normal source, or all 6.9 kV shutdown boards are aligned to their alternate source, the automatic transfer to the alternate source is not required to comply with GDC 17. See Figure 1 below for the following discussion. More specifically, under the alignment when each of the shutdown boards is supplied from its normal source (Shutdown Boards 1A-A and 2A-A supplied from CSST C and Shutdown Boards 1B-B and 2B-B supplied from CSST D), each of the circuits (P and R) are available in sufficient time (i.e., immediately) following a loss of all onsite alternating current (AC) power supplies and the other offsite electric power circuit, to assure that specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. In addition, under that same alignment, each of these circuits (P and R) is available within a few seconds (i.e., immediately) following a loss-of-coolant accident (LOCA) to assure that core cooling, containment integrity, and other vital safety functions are maintained.

Similarly, when all shutdown boards are aligned to their alternate source (Shutdown Boards 1A-A and 2A-A supplied from CSST D and Shutdown Boards 1B-B and 2B-B supplied from CSST C) each of the circuits (P and R) are available in sufficient time (i.e., immediately) following a loss of all onsite AC power supplies and the other offsite electric power circuit to assure that specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. In addition, under that same alignment, each of these circuits (P and R) is available within a few seconds (i.e., immediately) following a LOCA to assure that core cooling, containment integrity, and other vital safety functions are maintained. Under these alignments (all aligned to normal or all aligned to alternate) the normal-to-alternate fast transfer is not required to comply with GDC 17.

When one, two, or three 6.9 kV shutdown boards are aligned to their alternate source, the automatic normal-to-alternate fast transfer is required to comply with GDC 17. For example, in the case where one shutdown board is aligned to its alternate supply (e.g., Shutdown Board

1A-A is aligned to its normal source (CSST C), Shutdown Board 2A-A is aligned to its normal source (CSST C), Shutdown Board 1B-B is aligned to its alternate source (CSST C), and Shutdown Board 2B-B is aligned to its normal source (CSST D)) and CSST C (or its supplying circuit) is lost, then automatic transfer of Shutdown Boards 1A-A and 2A-A from their normal source (CSST C) to their alternate source (CSST D) is needed to ensure that one load group (load group A) (Shutdown Boards 1A-A and 2A-A) is available in sufficient time (i.e., approximately 6 cycles) following loss of all onsite AC power supplies and the loss of CSST C (or its supplying circuit) to assure that specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. Similarly under this example alignment, automatic transfer of Shutdown Boards 1A-A and 2A-A from their normal source (CSST C) to their alternate source (CSST D) is needed to ensure that load group A (Shutdown Boards 1A-A and 2A-A) is available within a few seconds following a LOCA to assure that core cooling, containment integrity, and other vital safety functions are maintained. If CSST D (or its supplying circuit) is lost while in this example alignment, load group A is available within a few seconds (i.e., immediately) to assure that specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. (Example alignments where other combinations of Shutdown Boards are supplied from their alternate source would similarly illustrate the need for the automatic normal-to-alternate transfer. These examples also demonstrate that automatic transfer from alternate-to-normal is not required to meet the specific GDC-17 requirements for (1) loss of all onsite AC power supplies and loss of the other offsite circuit and (2) LOCAs).

For more information on current WBN Unit 1 alignments, refer to UFSAR Figures 8.1-2 and 8.1-2A.

Table 1 below shows, in table format, different examples of shutdown board preferred power source alignments that WBN Unit 1 can currently be in and the alignments where an operable automatic transfer is required. As shown in Table 1, in the normal source alignment, the automatic shutdown board preferred source fast transfer is not required. When one, two, or three 6.9 kV shutdown boards are aligned to their alternate source, as shown in these examples, the fast transfer is required for the 6.9 kV shutdown boards aligned to their normal source.

ENCLOSURE
Watts Bar Nuclear Plant, Unit 1
Response to Request for Additional Information,
Offsite Power Availability Requirements

Table 1
General Design Criteria 17 Compliance
Current Alignments

| Alignments | Shutdown Board (SDB) | Power Source | | | | Operable SDB Transfer Required | Operable unit board Transfer Required | Notes |
|---|---|---|---|---|---|---|---|---|
| | | CSST A | CSST B | CSST C | CSST D | | | |
| Normal | 1A-A | | | • | | | | 1 |
| | 2A-A | | | • | | | | |
| | 1B-B | | | | • | | | |
| | 2B-B | | | | • | | | |
| Four Aligned to Alternate | 1A-A | | | | •* | | | 1 |
| | 2A-A | | | | •* | | | |
| | 1B-B | | | •* | | | | |
| | 2B-B | | | •* | | | | |
| One Aligned to Alternate | 1A-A | | | • | | • | | 2 |
| | 2A-A | | | • | | • | | |
| | 1B-B | | | •* | | | | |
| | 2B-B | | | | • | | | |
| Two Aligned to Alternate | 1A-A | | | | •* | | | 3 |
| | 2A-A | | | | •* | | | |
| | 1B-B | | | | • | • | | |
| | 2B-B | | | | • | • | | |
| Three Aligned to Alternate | 1A-A | | | | •* | | | 4 |
| | 2A-A | | | | •* | | | |
| | 1B-B | | | •* | | | | |
| | 2B-B | | | | • | • | | |

* Shutdown board aligned to alternate source.

**Notes**

1. On a loss of one preferred offsite circuit, one load group remains energized by the remaining offsite circuit with no transfer. A loss of either offsite circuit will not prevent the minimum safety functions from being performed.
2. With one shutdown board aligned to its alternate source, three shutdown boards will be aligned to one offsite circuit. The worst case failure would be a loss of the offsite circuit supplying three shutdown boards. A transfer of one load group from the normal source to the alternate source is required for one load group to remain energized and to maintain all safety functions.
3. With all four shutdown boards aligned to the same offsite circuit, i.e., two boards aligned to alternate source, on a loss of that circuit, the two boards aligned to the normal source must transfer to the alternate source for one load group to remain energized and to maintain all safety functions.
4. With three shutdown boards aligned to their alternate source, three shutdown boards will be aligned to one offsite circuit. The worst case failure would be a loss of the offsite circuit supplying three shutdown boards. A transfer of the board still aligned to the normal source must occur for one load group to remain energized and to maintain all safety functions.

When the maintenance source is aligned to a 6.9 kV unit board with the unit board aligned to its normal source (the unit station service transformer (USST)) with the alternate source (CSST A or B) in standby, the 6.9 kV unit board automatic fast transfer (i.e., approximately 6 cycles) is required for compliance with GDC 17. This alignment is shown in Figure 2 below. Under this alignment, the automatic fast transfer is required to meet GDC 17 to assure that specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded and to ensure that an offsite circuit is available within a few seconds following a LOCA to assure that core cooling, containment integrity, and other vital safety functions are maintained. The unit board power supply must transfer to the CSST to maintain one load group energized.

When a 6.9 kV shutdown board is aligned to its maintenance source with the associated 6.9 kV unit board aligned to its alternate source (CSST A or B), the automatic 6.9 kV unit board transfer from the 6.9 kV unit board normal source (the USST) to the 6.9 kV unit board alternate source is not required to comply with GDC 17. This alignment is shown in Figure 3 below. Under this alignment, the automatic fast transfer of the 6.9 kV unit board from its normal source to its alternate source is not required to meet GDC 17 because following a loss of all onsite AC power supplies and the loss of the D CSST (or its supplying circuit) load group A from CSST B is available to assure that specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded and that an offsite circuit is available within a few seconds following a LOCA to assure that core cooling, containment integrity, and other vital safety functions are maintained.

Planned Alignment

Table 2 presents similar information associated with use of the maintenance source (upon approval of this license amendment request). This table shows alignments where the maintenance source is aligned to the 6.9 kV shutdown boards and the maintenance source is powered from the normal power supply (the USST) or the alternate power supply (CSST A or B). When the 6.9 kV unit board is aligned to its normal power supply, the automatic 6.9 kV unit board fast transfer is required to comply with GDC 17.

Table 2
General Design Criteria 17 Compliance
Post-Approval Maintenance Alignments

| Alignments | Shutdown Board (SDB) | Power Source | | | | Operable SDB Transfer Required | Operable unit board Transfer Required | Notes |
|---|---|---|---|---|---|---|---|---|
| | | CSST A | CSST B | CSST C | CSST D | | | |
| CSST C OOS - 'A' SDBs on maintenance supply | 1A-A | | • | | | | | 1 |
| | 2A-A | | • | | | | | |
| | 1B-B | | | | • | | | |
| | 2B-B | | | | • | | | |
| CSST C OOS - 'A' SDBs on maintenance supply | 1A-A | | •# | | | | • | 2 |
| | 2A-A | | •# | | | | • | |
| | 1B-B | | | | • | | | |
| | 2B-B | | | | • | | | |
| CSST D OOS - 'B' SDBs on maintenance supply | 1A-A | | | • | | | | 1 |
| | 2A-A | | | • | | | | |
| | 1B-B | • | | | | | | |
| | 2B-B | • | | | | | | |
| CSST D OOS - 'B' SDBs on maintenance supply | 1A-A | | | • | | | | 2 |
| | 2A-A | | | • | | | | |
| | 1B-B | •# | | | | | • | |
| | 2B-B | •# | | | | | • | |

# Maintenance source aligned to USST (normal source) at unit board prior to unit board transfer to CSST.
OOS - Out-of-service

**Notes**

1. On a loss of one preferred offsite circuit, one load group remains energized by the remaining offsite circuit with no transfer. A loss of either offsite circuit will not prevent the minimum safety functions from being performed.
2. With two shutdown boards aligned to the maintenance source (6.9 kV unit boards) powered by the USST, a fast transfer from the USST power supply to the CSST power supply is required to maintain all safety functions.

CSST Capability

During the licensing of WBN Unit 2, the capability of each CSST (A, B, C, and D) was evaluated. In Supplemental Safety Evaluation Report (SSER) 22 (Reference 1), the NRC stated:

> As a result of its review of FSAR Section 8.2, the NRC staff focused on how TVA met the requirements of GDC 17 and 18 with respect to the design of the offsite circuits for the startup of WBN Unit 2. Specifically, the staff wanted to ensure the capacity and capability of the offsite circuits to permit functioning of the station safety systems given dual-unit operation. In addition, the staff wanted to ensure

that a loss of any one ac supply (offsite or onsite) would not result in the loss of the remaining sources, given dual-unit operation.

FSAR Section 8.2.1.2 describes the [CSSTs] and states that the calculated loading of the CSSTs is well below their winding ratings for all conditions. FSAR Position C2, on page 8.1-13, states, "The shared safety systems are designed so that one load group (Train 1A & 2A or Train 1B & 2B) can mitigate a design basis accident in one unit and accomplish an orderly shutdown of the other unit." These CSSTs are shared between WBN Units 1 and 2. In view of the Unit 2 and the Unit 1 loads being applied to the CSSTs, the NRC staff requested that TVA provide a summary of the calculations and analyses that detailed the loading for both units, or that added loads from WBN Unit 2 to the existing loads of Unit 1, including the design margin in the CSSTs assuming a DBA in one unit with a concurrent safe shutdown of the other unit.

The NRC staff reviewed TVA's response to confirm that the calculations assumed conditions consistent with an accident in one unit concurrent with a safe shutdown of the other unit, while supplied by offsite power. TVA's response confirmed that all operational alignments for offsite power supply to the units yield loadings well within the rating of the transformer, with design margins from 10 percent to as high as 48 percent. Specifically, CSSTs C and D (the normal preferred offsite circuits) have design margins of 48 percent and 32 percent, respectively. The staff finds this design acceptable. However, TVA should provide a summary of similar margin studies based on scenarios described in Section 8.1 above for CSSTs A, B, C, and D. In its December 6, 2010, letter, TVA provided additional information regarding transformer loadings. TVA stated that the loading for a dual-unit trip is slightly less than the loading for one unit in an accident and a spurious accident signal in the other unit. However, TVA did not provide a summary of the analysis for staff's review. TVA should provide a summary of similar margin studies based on a dual-unit trip as a result of an abnormal operational occurrence and an accident in one unit concurrent with a spurious ESF actuation. These should be based on the completed analysis for uprating CSSTs A and B. This is Open Item 27 (Appendix HH).

By letter dated April 6, 2011 (Reference 2), TVA stated:

A separate load flow was performed for a dual unit shutdown resulting from an abnormal operational occurrence with and without offsite power. The resulting loading on CSSTs is provided in the following tables:

| | Steady State Loading | | | Rating |
|---|---|---|---|---|
| | MW | MVAR | MVA | MVA |
| CSST C - X | 10.75 | 4.68 | 11.72 | 24/32/40 |
| CSST C - Y | 11.02 | 4.96 | 12.08 | 24/32/40 |
| CSST C - P | 21.80 | 10.69 | 24.28 | 33/44/55 |

(The above loading on CSST C is with both [engineered safety feature] ESF trains of both units powered from this transformer; CSST D is out of service.)

| | Steady State Loading | | | Rating |
|---|---|---|---|---|
| | MW | MVAR | MVA | MVA |
| CSST D - X | 10.75 | 4.69 | 11.73 | 24/32/40 |
| CSST D - Y | 11.02 | 4.96 | 12.08 | 24/32/40 |
| CSST D - P | 21.80 | 10.70 | 24.28 | 33/44/55 |

(The above loading on CSST D is with both ESF trains of both units powered from this transformer; CSST C is out of service.)

| | Steady State Loading | | | Rating |
|---|---|---|---|---|
| | MW | MVAR | MVA | MVA |
| CSST A - X | 21.86 | 9.28 | 23.75 | 36/48/60* |
| CSST A - Y | 29.89 | 17.72 | 34.75 | 36/48/60* |
| CSST A - P | 52.04 | 33.35 | 61.81 | 57/76/95* |

(The above loading on CSST A is with one ESF train of each unit transferred to this transformer. CSST D is out of service; CSSTs C, A, and B are available.)

| | Steady State Loading | | | Rating |
|---|---|---|---|---|
| | MW | MVAR | MVA | MVA |
| CSST B - X | 21.86 | 9.28 | 23.75 | 36/48/60* |
| CSST B - Y | 28.14 | 16.66 | 32.70 | 36/48/60* |
| CSST B - P | 50.29 | 31.82 | 59.51 | 57/76/95* |

(The above loading on CSST B is with one ESF train of each unit transferred to this transformer. CSST C is out of service; CSSTs D, A, and B are available.)

* The second FA rating for CSSTs A and B is "FUTURE."

The worst case margin for CSSTs C and D is 70% (X, Y winding) and 55% for primary winding. The worst case margin for CSSTs A and B is 27% (X, Y winding) and 18% for primary winding.

In SSER 24 (Reference 3), the NRC stated:

Open Item 27

In its letter dated April 6, 2011, TVA stated that, "A separate load flow was performed for a dual unit shutdown resulting from an abnormal operational occurrence with and without offsite power." TVA provided a summary of resulting loading on CSSTs. The staff reviewed the loading and margins available and concluded that the CSSTs are adequately rated for postulated conditions. Therefore, Open Item 27 is closed.

Summary

Under all alignments, WBN maintains compliance with GDC 17 by having two immediate access circuits either aligned directly to their credited offsite circuit or by utilizing a normal to alternate fast transfer. As a result, no additional TS required action limiting the duration when using the maintenance feeds through CSST A or B is needed.

**NRC RAI No. 2**

*In case of a LOOP event, the onsite power sources are required to connect to the safety busses. In order to recover from a LOOP or a station blackout (SBO) event, the offsite power sources have to be restored to the safety busses. The current TS surveillances validate the capability to parallel the onsite and offsite sources for successful transfer between the two sources through CSSTs C and D. To demonstrate operability of a power source, the licensee has to perform periodic surveillances in their required power source alignment to comply with the requirements of 10 CFR 50.36. The current TS proposal to use CSST A or B as GDC 17 sources does not appear to have TS surveillances to validate a similar capability. Please provide information on surveillances that will be performed to demonstrate the operability of the circuits between the switchyard and the safety busses through CSST A or B.*

**TVA Response**

When CSST A or B are used as a qualified offsite circuit, the ability to restore offsite power to the 6.9 kV shutdown boards is confirmed before the source is considered operable. WBN Unit 1 TS LCO 3.8.1 requires that two qualified circuits between the offsite transmission network and the onsite Class 1E AC Electrical Power Distribution System, and four DGs capable of supplying the onsite Class 1E AC Electrical Power Distribution System be operable. To assure that the necessary quality of systems and components is maintained, that facility operation will be within the safety limits, and that limiting conditions for operation are met, SRs relating to testing, calibration, or inspection at specified frequencies are included in accordance with 10 CFR 50.36(c)(3). WBN Unit 1 TS 3.8.1, AC Sources – Operating, contains SRs associated with qualified offsite circuits and DGs. To verify operability of offsite circuits, TS 3.8.1 requires

SR 3.8.1.1* and SR 3.8.1.8† to be performed. To verify operability of the CSST A or B qualified offsite circuits, SR 3.8.1.1 and the new SR 3.8.1.22‡ will be performed. The other SRs included in TS 3.8.1 verify the operability of the DGs.

In the event of a LOOP, the DGs will be supplying their respective 6.9 kV shutdown boards. Surveillance Requirement (SR) 3.8.1.16 verifies each DG has the ability to control DG frequency and voltage to allow synchronizing with the offsite power source while loaded with emergency loads, transfers loads to the offsite power source, and returns to ready-to-load operation. The DG controls would be the same regardless of which offsite power supply is aligned to the shutdown board.

For either maintenance preferred offsite power source to be operable, it must be in one of two alignments. One alignment (refer to Figure 3) has the associated CSST (A or B) directly connected to the 6.9 kV shutdown board through the 6.9 kV unit board and the maintenance feeder. The other acceptable alignment (refer to Figure 2) is for the maintenance preferred offsite power source to be connected to the USST through the 6.9 kV unit board with the automatic 6.9 kV unit board transfer operable from normal (USST) to alternate (CSST) and with the CSST in standby.

In either alignment, the circuit from the CSST to the 6.9 kV shutdown board is confirmed (SR 3.8.1.1 and SR 3.8.1.22) before it is considered operable. The ability of a DG to synchronize with the offsite power source while loaded with emergency loads; transfer loads to the offsite power source; and return to ready-to-load operation is confirmed by SR 3.8.1.16, as described above. The same approach described above would verify the capability to parallel the onsite and offsite sources during recovery from an SBO when the 6.9 kV shutdown boards are returned to a normal alignment if the DGs were available before offsite power was available.

Currently, the shutdown board normal and alternate supply breakers are maintained in the manner specified below. The shutdown board maintenance supply breakers are maintained similar to the normal and alternate breakers prior to their use.

- Breakers are maintained under the breaker maintenance program.
- Protective relays are periodically calibrated and functionally tested.
- Logic circuits are periodically tested.
- Cubicles are inspected and tested.
- Surveillances are performed to validate degraded and under voltage trip logic.

Therefore, the ability to transfer the 6.9 kV shutdown board's load from the DG to the preferred power source is confirmed before the preferred power source is considered operable and no additional SRs are needed.

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* SR 3.8.1.1 - Verify correct breaker alignment and indicated power availability for each offsite circuit at a frequency of 7 days.

† SR 3.8.1.8 - Verify automatic and manual transfer of each 6.9 kV shutdown board power supply from the normal offsite circuit to each alternate offsite circuit at a frequency of 18 months.

‡ SR 3.8.1.22 - Verify automatic transfer of each 6.9 kV Unit Board 1B, 1C, 2B, and 2C power supply from the normal power supply to the alternate power supply at a frequency of 18 months.

**NRC RAI No. 3**

*Please confirm that the components in the circuits associated with CSSTs A and B, 161 kV switchyard and the safety busses will be subjected to the requirements of the Maintenance Rule as applicable under 10 CFR 50.65 "Requirements for monitoring the effectiveness of maintenance at nuclear power plants."*

**TVA Response**

The TVA WBN Maintenance Rule is controlled in accordance with the program document (NPG-SPP-03.4, "Maintenance Rule Performance Indicator Monitoring, Trending and Reporting - 10 CFR 50.65"). This procedure implements the requirements of 10 CFR 50.65. The present Maintenance Rule scope for WBN Unit 1 and 2 is documented in procedure 0-TI-119, "Maintenance Rule Performance Indicator Monitoring, Trending, and Reporting - 10 CFR 50.65."

The CSSTs A and B are part of System 200 and are in the scope of the rule. This system is monitored at both Plant Level and Specific Level. CSSTs C and D have been determined to be risk significant and are monitored at Specific Level with unavailability and unreliability criteria. CSSTs A and B are risk significant and are monitored using Plant Level criteria. Once this license amendment request is approved, CSSTs A and B will be monitored similar to CSSTs C and D, that is, at the Specific Level with unavailability and unreliability criteria.

The 161 kV WBH switchyard is not in the scope of the maintenance rule. The maintenance rule scope stops in the WBN switchyard at the 161 kV line connections to the CSSTs.

The safety related shutdown boards are in the scope of the maintenance rule. The CSSTs feed the safety buses which are part of System 211. The safety related shutdown boards are risk significant and monitored at Specific Level with unavailability and unreliability criteria.

**NRC RAI No. 4**

*Assuming that CSST A or B is being used as an offsite power source for the safety [boards] with both WBN units operating at full power, the sequence of events following an accident signal in one unit could be reactor trip, turbine trip and a delayed generator trip depending on the coast down time of the generator. The safety buses will have accident loads block loaded while the generator in coast down. After the generator trip, the safety busses will be transferred to the CSST A or [B] depending on the selected source. Please provide the following information:*

*i. A summary of analyses performed to demonstrate the consequences of this sequence of events on the accident analyses.*

*ii. Details or referenced information in the licensing basis documenting the adequacy of this design as related to accident analyses.*

*iii. Summary of electrical system analyses performed with the grid at minimum allowable voltage and simultaneous restart or reacceleration of all safety related and non-safety related loads, assuming a design basis accident in one unit and simultaneous orderly shutdown of the other unit.*

**TVA Response**

i. A summary of analyses performed to demonstrate the consequences of this sequence of events on the accident analyses.

If a reactor trip and subsequent turbine trip occurs, the generator will be motored through the generator step-up transformers (GSUs), with the voltage sustained by the generator's voltage regulator. The voltage and frequency will be maintained at the 6.9 kV unit boards from offsite power thru the USSTs. The accident loads will accelerate while connected to the USSTs. At 30 seconds, the reverse power relay will initiate a fast transfer (approximately 6 cycles) of the running loads to the CSSTs and initiate a generator trip. The Class 1E loads will have already accelerated when transferred to the CSSTs. There is no coast down of the generator while the 6.9 kV unit boards are supplied from the USSTs.

ii. Details or referenced information in the licensing basis documenting the adequacy of this design as related to accident analyses.

The loading sequence as discussed in this response has been analyzed in the AC Auxiliary Power System Analysis Calculation, EDQ00099920070002, and evaluated in SSER 22. The criterion for acceptability is the same as for the alignment to CSSTs C and D.

iii. Summary of electrical system analyses performed with the grid at minimum allowable voltage and simultaneous restart or reacceleration of all safety related and non-safety related loads, assuming a design basis accident in one unit and simultaneous orderly shutdown of the other unit.

The transfer scheme as described in this response does not cause a double sequencing of accident loads. See the description in section (i) above. The criteria for acceptability of the sources are the same as for the alignment to CSSTs C and D.

**NRC RAI No. 5**

*Since the operation of non-safety related circuit breakers related with offsite power sources is critical for separation and restoration of power from the switchyard, plant designs incorporate redundant trip coils and closing coils powered from reliable DC sources. Please confirm if the circuit breakers associated with CSSTs A and B and offsite power source have similar design features.*

**TVA Response**

In the current plant design the circuit breakers associated with CSSTs C and D do not contain redundant trip coils or closing coils. Similarly, the breakers associated with CSSTs A and B do not contain redundant trip coils or closing coils. The two offsite sources from the CSSTs to the shutdown boards are maintained in separate routings with different control power sources. This independence reduces the likelihood of a LOOP to more than one train of shutdown boards.

**References**

1. NUREG-0847, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2," Supplement 22, published February 2011.

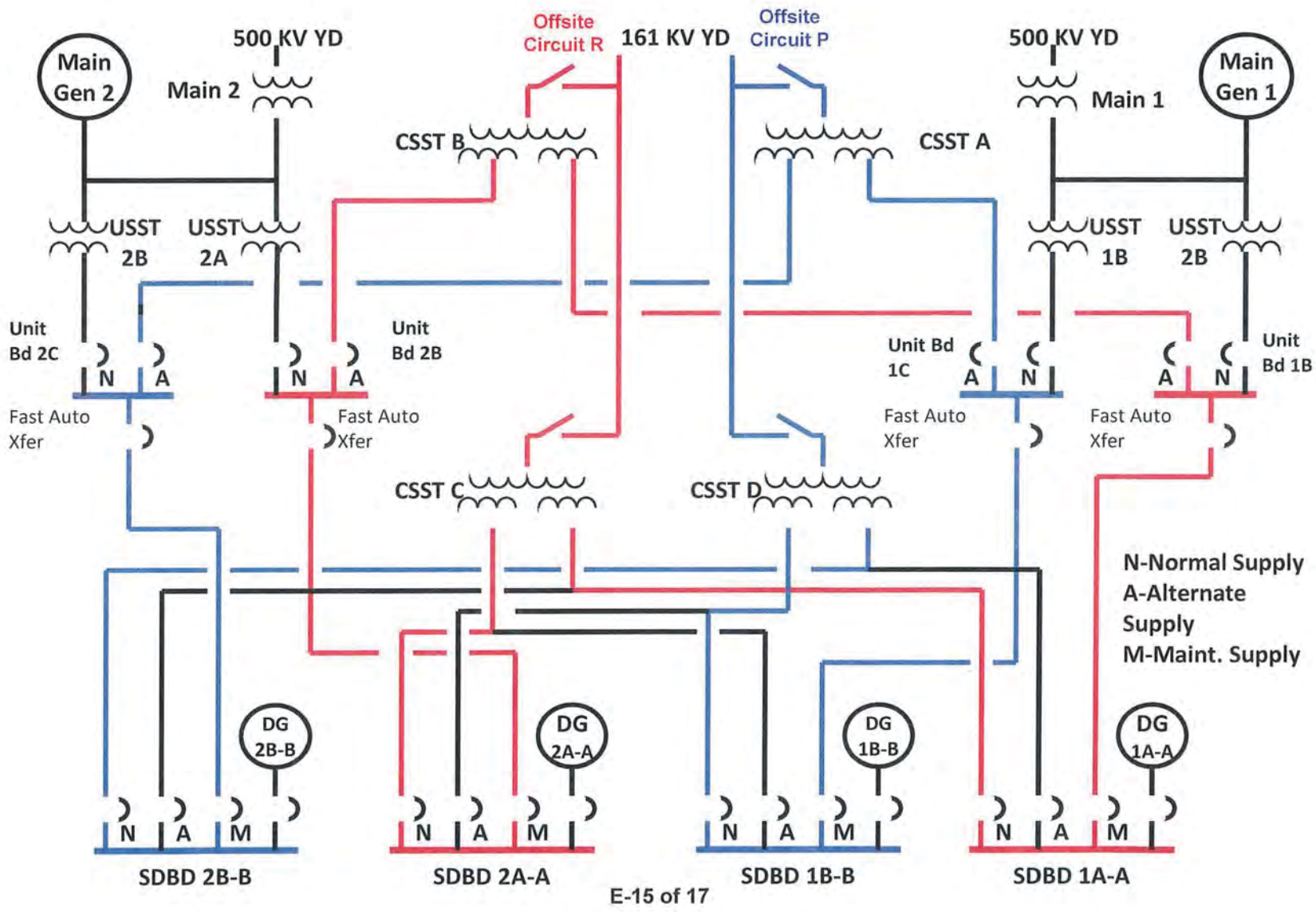
2. TVA Letter to NRC, "Watts Bar Nuclear Plant (WBN) Unit 2 – Safety Evaluation Report Supplement 22 (SSER 22) - Response to NRC Required Action Items," dated April 6, 2011.

3. NUREG-0847, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2," Supplement 24, published September 2011.

ENCLOSURE

# Off Site Power Supplies

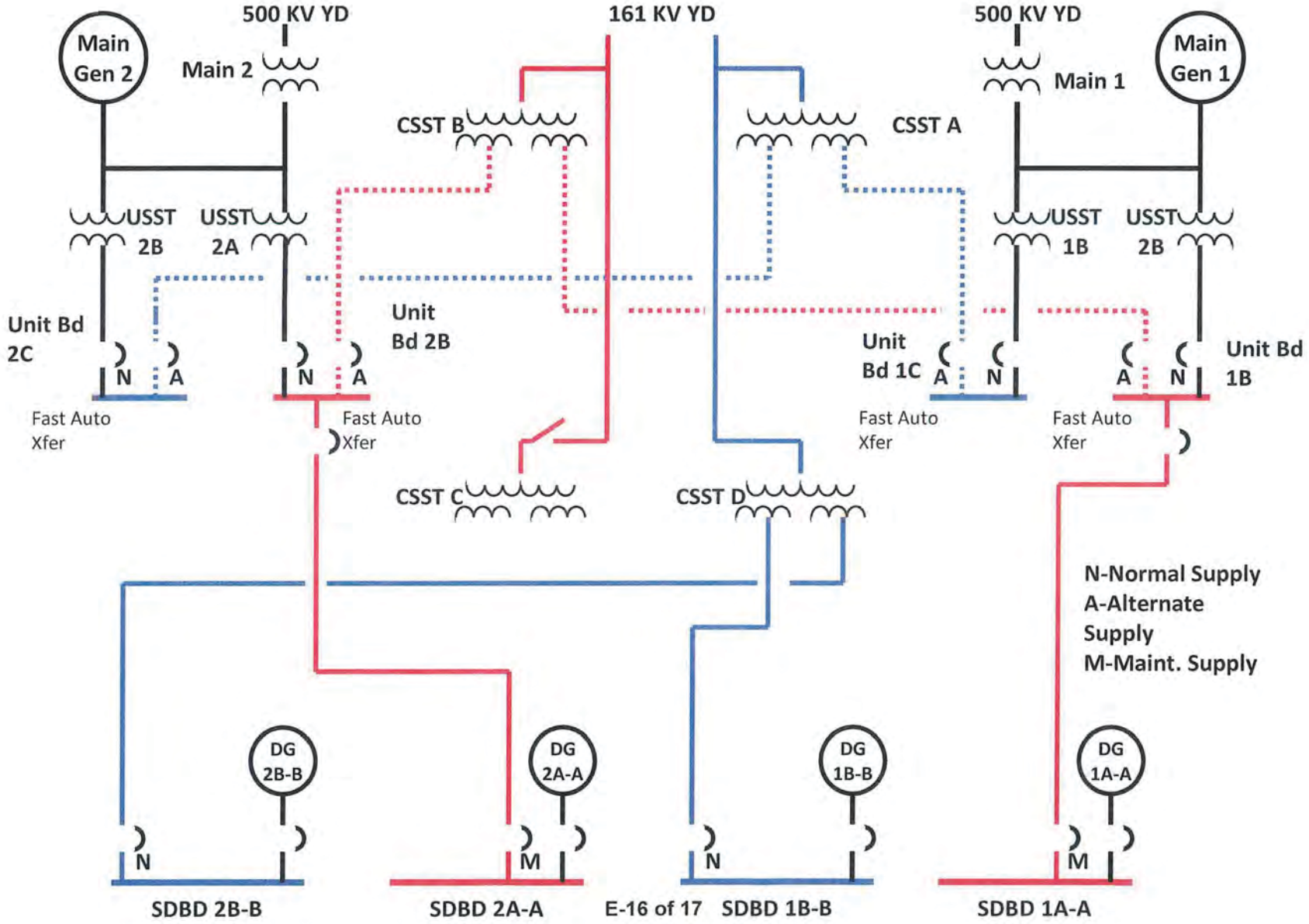
Figure 1



ENCLOSURE

# C CSST OOS, Maint. Supply In Serv. For Train A , Aligned to USST

Figure 2



ENCLOSURE

# C CSST OOS, Maint. Supply In Serv. For Train A , Aligned to CSST B

Figure 3