WBN2Public Resource

From: Boyd, Desiree L [dlboyd@tva.gov]
Sent: Tuesday, August 31, 2010 8:17 AM
To: Wiebe, Joel; Raghavan, Rags; Milano, Patrick; Campbell, Stephen
Subject: 08-30-10 TVA letter to NRC - FSAR RAI Responses
Attachments: 08-30-10 - FSAR RAI Responses_NRC Copy.pdf

Please see attached letter that was sent to the NRC today.

~*~*~*~*~*~*~*~*~*~*~*~*~*~*~*~

Désireé L. Boyd

WBN 2 Licensing Support

Sun Technical Services

dlboyd@tva.gov

423-365-8764

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Created By: dlboyd@tva.gov

Recipients:
"Wiebe, Joel" <Joel.Wiebe@nrc.gov>
Tracking Status: None
"Raghavan, Rags" <Rags.Raghavan@nrc.gov>
Tracking Status: None
"Milano, Patrick" <Patrick.Milano@nrc.gov>
Tracking Status: None
"Campbell, Stephen" <Stephen.Campbell@nrc.gov>
Tracking Status: None

Post Office: TVANUCXVS2.main.tva.gov

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

August 30, 2010

10 CFR 50.4(b)(6)
10 CFR 50.34(b)
10 CFR 2.390(d)(1)

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

Watts Bar Nuclear Plant, Unit 2
NRC Docket No. 50-391

Subject: Watts Bar Nuclear Plant (WBN) Unit 2 – Final Safety Analysis Report (FSAR) – Response to Requests for Additional Information

This letter responds to a number of both preliminary requests for additional information (RAIs) and RAIs regarding the Unit 2 FSAR.

Enclosure 1 provides the responses to preliminary RAIs and RAIs involving multiple FSAR chapters.

The electronic files of documents noted as being provided by the response to specific RAIs are contained on the enclosed Optical Storage Media (OSM). Enclosure 2 lists the electronic files and the file sizes.

Attachment 2 of Enclosure 2 contains information proprietary to Westinghouse. TVA requests that this Westinghouse proprietary information be withheld from public disclosure in accordance with 10 CFR § 2.390. Attachment 1 of Enclosure 3 contains their Application for Withholding Proprietary Information from Public Disclosure Affidavit.

Enclosure 3 provides the new commitments contained in this letter.

If you have any questions, please contact Bill Crouch at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 30th day of August, 2010.

Sincerely,

Masoud Bajestani
Watts Bar Unit 2 Vice President

Enclosures:

1. Response to RAIs Regarding Unit 2 FSAR
2. List of Files Provided on Enclosed Optical Storage Media (OSM)
3. List of New Regulatory Commitments

cc (Enclosures):

U. S. Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Ave., NE Suite 1200
Atlanta, Georgia 30303-1257

NRC Resident Inspector Unit 2
Watts Bar Nuclear Plant
1260 Nuclear Plant Road
Spring City, Tennessee 37381

bcc (Enclosures):

Stephen Campbell
U.S. Nuclear Regulatory Commission
MS 08H4A
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2738

Loren R. Plisco, Deputy Regional Administrator for Construction
U. S. Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Ave., NE Suite 1200
Atlanta, Georgia 30303-1257

ENCLOSURE 1

Response to RAIs Regarding Unit 2 FSAR

Tennessee Valley Authority - Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

Preliminary RAIs for FSAR 3.5.1 & 3.5.3 (taken from e-mail from NRC dated 02/22/2010)

Section 3.5.3 Barrier Design Procedures

3.5.3 - 1. On page 3.5-30, have references (17), (18), and (19) been approved by the staff? If yes, by whom and when; if not, please provide for the staff to review.

Response: The references of concern were numbered as (17), (18), and (19) in Amendment 95 to the Unit 2 FSAR. In Amendment 99 to the Unit 2 FSAR, these have been re-numbered as (18), (19), and (20).

None of these references have been approved by the NRC.

Reference (18) is "WCAP-16501-P, Revision 0, 'Extension of Turbine Valve Test Frequency Up to 6 Months for BB-296 Siemens Power Generation (Westinghouse) Turbines with Steam Chests', February 2006, Westinghouse Electric Company, LLC, Westinghouse Proprietary Class 2." The enclosed OSM includes an electronic version of the following:

- Westinghouse - Application For Withholding Proprietary Information From Public Disclosure CAW-10-2890, dated July 16, 2010; Subject: WCAP-16501-P, Revision 0, "Extension of Turbine Valve Test Frequency Up to 6 Months for BB-296 Siemens Power Generation (Westinghouse) Turbines with Steam Chests" (Proprietary)

- Westinghouse - Extension of Turbine Valve Test Frequency Up to 6 Months for BB-296 Siemens Power Generation (Westinghouse) Turbines with Steam Chests (Document Number WCAP-16501-P, Revision 0, February 2006) (Westinghouse Proprietary Class 2)

- Westinghouse - Extension of Turbine Valve Test Frequency Up to 6 Months for BB-296 Siemens Power Generation (Westinghouse) Turbines with Steam Chests (Document Number WCAP-16501-NP, Revision 0, February 2006) (Westinghouse Non-Proprietary Class 3)

Reference (19) is "Technical Instruction TI-227, 'Turbine Integrity Program with Turbine Overspeed Protection (TIPTOP)", Revision 3, October 24, 2008, TVA Watts Bar Nuclear Plant." The enclosed OSM includes an electronic version of TI-227.

Reference (20) is "EC-02262, 'Missile Generation Risk Assessment for Original and Retrofit Nuclear HP Rotors', December 17, 2002, Siemens Westinghouse Power Corporation." The enclosed OSM includes an electronic version of the following:

- Siemens - WB2-TJM-046, dated February 26, 2010, Subject: Siemens Authorization for TVA to Distribute Siemens Nuclear HP Turbine Missile Report EC-02262 to the NRC for Use and Publication TVA Watts Bar #2 Completion, Upgrade & Startup Project

- Siemens - Missile Generation Risk Assessment for Original and Retrofit Nuclear HP Rotors (Document Number EC-02262, December 17, 2002)

ENCLOSURE 1

Response to RAIs Regarding Unit 2 FSAR

Tennessee Valley Authority - Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

RAIs for Various Portions of the FSAR [from NRC letter dated 06/23/2010 (ADAMS Accession No. ML101450084)]

Nuclear Performance and Code Review (SNPB)

All references to Watts Bar Unit 1 (WB1) are from the approved UFSAR Amendment 7. All references to Watts Bar Unit 2 (WB2) are from Amendment 95 which is currently under review.

SNPB 4.2.1 - 3. Should the References given in Section 4.2.1.1.1 for WBN Unit 2 match those for WBN Unit 1?

a. Why is reference [25] removed from WBN Unit 1 FSAR, but used in WBN Unit 2 FSAR?

Response: The references in the Amendment 95 version of Unit 2 FSAR Section 4.2.1.1.1 should match those for Amendment 7 of the Unit 1 UFSAR with the exception of Unit 1 Reference [26].

Reference [26] for Unit 1 FSAR is the licensed topical for the PAD 3.4 design model. The current licensed design model is PAD 4.0, as seen in topical report WCAP-15063-P-A, Revision 1, with Errata (Reference [35] for both Amendment 7 of the Unit 1 UFSAR and the Amendment 95 version of the Unit 2 FSAR). Since the PAD 3.4 design model is not used for Unit 2, the reference to it is not needed in the Unit 2 FSAR.

Additionally, note that the Unit 2 References contains duplicates as follow:

[25] and [26] are the non-proprietary and proprietary versions, respectively of the same document.

[26] and [35] are the same reference.

Amendment 101 to the Unit 2 FSAR will remove References [25] and [26].

b. Why are [31], [32], and [35] referenced for WBN Unit 1 and not WBN Unit 2?

Response: In order for the other references from Unit 1 UFSAR and Unit 2 FSAR to match, the following changes will be made:

WBN Unit 1 FSAR Amendment 8:

Add Reference [33] to the following statement: "The fuel rods are designed for extended burnup operations using the NRC approved Westinghouse extended burnup design methods, models and criteria in References [26], [27], [31], [32], and [35]."

Unit 2 FSAR:

Perform the following actions for the statement, "The fuel rods are designed for extended burnup operation using the NRC approved Westinghouse extended burnup design methods, models and criteria in References [25], [26], and [27]."

- Remove Reference [25]; it is identical to Reference [33].
- Remove Reference [26]; it is identical to Reference [35].
- Add References [31], [32], [33], and [35].

References for 4.2.1.1.1 will then be consistent between the Unit 1 UFSAR and the Unit 2 FSAR, with the exception of Reference [26] as noted in the response to **RAI SNPB 4.2.1 - 3.a**.

Amendment 101 to the Unit 2 FSAR will revise the sentence in 4.2.1.1.1 as delineated above.

RAIs for FSAR Section 9.1 - SBPB [taken from NRC letter dated 07/07/2010 (ADAMS Accession No. ML101620047)]:

Background:

Many of the fuel storage and handling related structures, systems, and components within the WBN Auxiliary Building are shared between the two units, including the spent fuel pool, the spent fuel cooling and cleanup system, and the spent fuel handling equipment. The WBN Unit 2 FSAR describes the degree of conformance with the NRC General Design Criteria (GDC) of Title 10, Code of Federal Regulations (10 CFR) Part 50, Appendix A. The ability of shared systems to perform their safety functions for credible combinations of normal and accident states is addressed in GDC 5. Pursuant to the requirements of 10 CFR 50.34(b), applicants for operating licenses must include in the FSAR a description and analysis of the structures, systems, and components of the facility, and the evaluations required to show that safety functions will be accomplished.

SBPB 9.1 - 3. Address intentions with regard to implementation of the guidelines in NEI 08-05, “Industry Initiative for Control of Heavy Loads,” for WBN Unit 2.

Response: NEI 08-05 provides guidance for the implementation of regulatory guidance associated with heavy load lifts, namely reactor pressure vessel closure heads. Implementation of this guidance is achieved by the following:

NSIAC Heavy Loads Initiative

Unit 2 will comply with the Phase I Guidelines of NUREG-0612,”Control of Heavy Loads.” The method of compliance will be substantially similar to the current Unit 1 program.

Maintenance Rule 10 CFR 50.65(a)(4) Considerations

Unit 2 will adhere to the following TVA fleet procedures which contain requirements and guidance to assess and manage the risk associated with heavy load lifts:

- NPG-SPP-07.1, “On Line Work Management”
- SPP-7.2.1.1, “Shutdown Risk Management”
- SPP-7.3, “Work Activity Risk Management Process”

Reactor Head Lift Single Failure Proof Crane Equivalence

Unit 2 will qualify the Polar Crane as a Single Failure Proof Equivalent per Chapter 3 of NEI 08-05. Calculation WCG-1-2010 contains this qualification and will be revised to include the Unit 2 Polar Crane by October 29, 2010.

FSAR Update

The Unit 2 FSAR will be updated to include a new Section 3.12, to include the basis for conducting safe heavy load movements, including commitments to safe load paths, load handling procedures, training of crane operators, use of special lifting devices, use of slings, crane design, and inspection, testing, and maintenance of the crane. The Unit 2 FSAR Section 3.12 will be materially equivalent to the current Unit 1 UFSAR Section 3.12. The new Unit 2 Section 3.12 will be submitted to the NRC by November 24, 2010.

ENCLOSURE 1

Response to RAIs Regarding Unit 2 FSAR

Tennessee Valley Authority - Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

RAIs [taken from NRC letter dated 06/29/2010 (ADAMS Accession No. ML101620006)]:

Nuclear Performance and Code Review (**SNPB**)

Chapter 4.3.3

SNPB 4.3.3 - 1. In WBN Unit 2 Amendment No. 95 section 4.3.3.2, should reference 57 from WBN Unit 1 Chapter 4.3 be added to identify which ENDF/B-VI files are being specified (p 4.3-34)?

Response: Yes, Chapter 4.3 reference 57 from Unit 1 UFSAR Amendment No. 7 (regarding ENDF/B-VI files) is an appropriate reference for Unit 2.

Amendment 101 to the Unit 2 FSAR will incorporate the following changes:

The first sentence of the next to last paragraph of 4.3.3.2 will be revised to read "PHOENIX-P employs a multi-group library derived mainly from the ENDF/B-VI files. [57]" instead of "PHOENIX-P employs a 42 energy group library derived mainly from the ENDF/B-VI files."

Reference (57), as follows, will be added to page 4.3-44:

"(57) Rose, P. F., "ENDF-201 ENDF/B-VI Summary Documentation," BNL-NC8-17541 [ENDF-201] 4th Edition [ENDF-B-VI], October 1999 and Supplements."

Response to RAIs Regarding Unit 2 FSAR

Tennessee Valley Authority - Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

RAI for FSAR 15.5 [from NRC letter dated 06/11/2010 (ADAMS Accession No. ML101540133)]

15.5 - 1. To ensure a complete and accurate safety assessment of the proposed changes to the Watts Bar FSAR, the NRC staff needs to assess the safety significance of all of the changes to the current licensing basis (CLB) parameters used in the dose consequence analyses described in Chapter 15.5.

Please provide additional information describing, for each design basis accident described in FSAR Section 15.5, all the basic parameters used in the dose consequence analyses. For each parameter, please list the WBN Unit 1 CLB value, the revised value where applicable as will be applied to both WBN Units 1 and 2, and the basis for any changes made to the WBN Unit 1 CLB values. The NRC staff requests that this information be presented in separate tables for each accident evaluated.

Response: Per discussion with NRC, the question is not being answered with respect to Unit 1. In addition, electronic versions of calculations specified below are being provided in lieu of a list of specific parameter values.

To respond to this RAI, copies of calculations for each of the seven primary postulated events described in Unit 2 FSAR Section 15.5 are being provided. The following Table represents each of these postulated events and identifies the appropriate calculation from which the FSAR published data was derived. The Table also provides the appropriate FSAR table in which the data is found. Dose consequence analysis parameters are found within each of the listed calculations.

EVENT	CALCULATION(s)	FSAR TABLE(s)
1. Loss of Coolant Accident	TIRPS197 (off-site) TIRPS198 (operator)	15.5-6, 15.5-7, 15.5-8, 15.5-9, and 15.5-14
2. Recirculation Loop Leakage Post LOCA	WBNAPS3078	15.5-12 and 15.5-13
3. Loss of AC Power	WBNTSR080	15.5-1, 15.5-2, and 15.5-14
4. Steam Line Break	WBNAPS3077	15.5-14, 15.5-16, and 15.5-17
5. Steam Generator Tube Rupture	WBNTSR008	15.5-14, 15.5-18, and 15.5-19
6. Waste Gas Decay Tank Rupture	WBNTSR064	15.5-3, 15.5-4, 15.5-5, and 15.5-14
7. Fuel Handling Accident	WBNTSR009	15.5-14, 15.5-20, 15.5-21, and 15.5-23

ENCLOSURE 1

Response to RAIs Regarding Unit 2 FSAR

Tennessee Valley Authority - Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

RAIs [taken from NRC letter dated 07/32/2010 (ADAMS Accession No. ML102020281):

FSAR Section 3.11

3.11 - 1. On Page 3.11-1 of the FSAR, the licensee stated the following:

> Two programs are in place to environmentally qualify safety-related electrical equipment (including cable) and active safety-related mechanical equipment to function or not fail for event mitigation. These programs involve:
>
> (1) Safety-related electrical equipment within the scope of 10 CFR 50.49.
>
> (2) Active, safety-related mechanical equipment located in a harsh environment.

Confirm that the Environmental Qualification program for Watts Bar Nuclear Plant, Unit 2 includes guidance for qualifying 1) nonsafety-related electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions identified in 10 CFR 50.49 and 2) required post-accident monitoring equipment.

Response: The Watts Bar Nuclear (WBN) Plant Design Criteria for , Environmental Qualification to 10 CFR 50.49 provides guidance for qualifying:

1) safety-related electrical equipment (Class 1E) required for a DBE to maintain the reactor coolant system pressure boundary; the capability to shut down the reactor and maintain it in a safe shutdown condition; the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the 10 CFR 100 guidelines [10 CFR 50.49 (b) (1)];

2) nonsafety-related electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions identified in 10 CFR 50.49 by the safety-related equipment [10CFR50.49 (b) (2)]; and

3) certain post-accident monitoring (PAM) equipment [10 CFR 50.49 (b) (3)].

The guidance provided in the Design Criteria is incorporated in the Unit 2 Construction Completion Project Procedure for Equipment Environmental Qualification (EQ) Program and is implemented under the Unit 2 EQ Program described in this procedure. This procedure is based on the TVAN Corporate Procedure for Equipment Environmental Qualification (EQ) Program which is also the same Program for Unit 1.

TVA calculation, "10CFR50.49 Category and Operating Times(Cat & OP) Methodology," defines the methodology and bases necessary to determine the required category and operating times for all safety-related devices located in areas subject to harsh environmental conditions in accordance with 10 CFR 50.49. In addition, the Category & Operating Times calculations identify, by safety-related systems, the 10 CFR 50.49 equipment and PAM devices.

TVA calculation, "Nonsafety-related Electric Equipment Process Interfaces Important to Safety Per 10CFR50.49 b (2)," documents the evaluation of the failure of non safety-related devices and their effects upon safety-related circuits per 10 CFR 50.49 b (2) requirements.

3.11 - 3. On Page 3.11-1 of the FSAR, the licensee stated the following:

> A mild environment is defined as a room or building zone where, (3) the event radiation is less than or equal to 1E4 rad.

Clarify that a mild environment for electronic components such as semiconductors or electronic components containing organic material is a total integrated dose less than 1E3 rad, and a mild radiation environment for other equipment is less than 1E4 rad.

Response: As established in the Watts Bar Environmental Qualification Nuclear Design Criteria Document and consistent with the current Unit 1 Licensing Basis, the upper threshold for the EQ Mild Environment is established at 1×10^4 Rads for all components.

Recognizing that certain components, e.g., Metal Oxide Semiconductors (MOS), PIN Diodes, may have a somewhat lower threshold for impacts from radiation exposure, Watts Bar requires the following:

- Per design standards, any device, whether in a mild, essentially mild, or harsh environment, is required to be purchased to the environmental conditions where it is to be located. That includes the usual radiation, temperature, humidity, etc. guidelines. An environmental conditions data sheet with the stated environmental parameters is sent to the manufacturer along with the purchase request and we ask the vendor to meet those conditions.

- For MOS, CMOS or like circuitry, the same holds true. But, the design standard for qualification of electrical equipment in a harsh environment specifically requires that any of this type circuitry be evaluated on a case-by-case basis for any gamma dose exceeding 1×10^3 Rads.

3.11 - 4. On page 3.11-2 of the FSAR, the licensee stated the following:

> Abnormal operating conditions – The environmental service conditions which result from outside temperature excursions, temporary greater than design heat loads, or degraded environmental control operations. This condition can exist for up to 12 hours per excursion for non-reactor building spaces and will occur less than 1% of the plant life, unless alternate times and %0+ plant life conditions are specifically approved in reference [4] and its associated environmental data drawings.

a. Explain the basis for increasing the time from 8 to 12 hours.

Response: DCN 35455 revised the duration time from 8 to 12 hours per excursion, which made the duration time consistent with plant shift round timing. This change does not impact the abnormal condition occurring for less than 1% of plant life.

b. Clarify what is meant by "%0+ plant life conditions."

Response: The '%0+' is the nomenclature used to provide some latitude for abnormal temperature conditions that may exist for varying time periods (different than 12 hours) and can be a certain % (greater than 0) as long as it is specifically approved in design criteria WB-DC-40-42.

These changes make the U2 FSAR wording consistent with the Unit 1 UFSAR wording.

3.11 - 5. Explain the basis for removing the Boron Injection Tank from the list in FSAR Section 3.11.7.1.

Response: A Watts Bar plant specific analysis was performed by Westinghouse for the WBN MSLB transients and concluded the Boron Injection Tank (BIT) may be bypassed or eliminated. Other advantages included eliminating the Technical Specifications requirements for maintaining BIT high boron concentration, the redundant BIT to Boric Acid Tank (BAT) recirculation pumps, associated piping, and the associated heat redundant tracing system. It is noted the BIT tank was not physically removed from the plant and remains in service within the CVCS Centrifugal Charging Pumps charging path from the Refueling Water Storage Tank (RWST) to the Reactor Coolant System as shown on Flow Diagram 2-47W811-1.

The acceptability of the above changes was made possible because of changes in the Westinghouse internal criterion for the Condition II and IV MSLB transients. The following cases were reanalyzed for BIT boron concentration reduction and the bypass or eliminated BIT system alternative with respect to the core integrity section.

> "Hypothetical" MSLB, This analyses included with and without Off-Site Power available, for the largest double ended rupture of a steam pipe.

"Credible" MSLB, This analyses included with Off-Site Power available for the largest single failed open Steam generator relief, safety, or steam dump valve.

Both uniform and non-uniform cases were analyzed in the above analyses. A uniform analysis refers to an equal blow from all four steam generators and a non-uniform analysis refers to a blow down from a single steam generator.

The LOFTRAN system transient analysis computer code included models of the reactor core, steam generators, pressurizer, primary piping, protection systems, and engineering safeguards. In addition, changes in safety injection system initial boron concentration and temperatures were introduces into the LOFTRAN computer code. The analyses concluded for the BIT boron concentration reduction [1] radiation releases remained within the requirements of 10CFR100 by demonstrating that the DNB design basis was met with a conservative initially assumed 1% failed fuel in the RCS for the Hypothetical transients and [2] no additional fuel damage would occur even if the nuclear fuel return to criticality following the initiation of the event for the Credible transient.

ENCLOSURE 1

Response to RAIs Regarding Unit 2 FSAR

Tennessee Valley Authority - Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

Preliminary RAIs for FSAR 3.9.1, 3.9.2, 3.9.3, 10.4.7, and sections on AC Power System [taken from NRC letter dated 08/09/2010 (ADAMS Accession No. ML101870682):

1. Essential Raw Cooling Water (ERCW): FSAR Section 9.2.1.3 states "ERCW system has eight pumps (four pumps per train). However, minimum combined safety requirements for one 'accident' unit and one 'non–accident' unit, or two 'non-accident' units, are met by only two pumps on the same plant train. Sufficient redundancy, separation and independence of piping and components are provided to ensure that cooling is maintained to vital loads at all times despite the occurrence of a random single failure."

Clarify the statement "two pumps on the same plant train" as related to the total number of pumps required for safe shutdown of both units. If the total number of pumps required for safe shutdown of two units is "two on the same train," then provide information on how adequate separation (electrical and physical) is maintained between each pump and the associated power/control circuits for safe shutdown of both units following a plant fire.

Response: There are a total 8 pumps, two on each of the four 6.9kV shutdown boards (4 pumps per train) as follows:

- Unit 1 Train A (6.9kV Shutdown Board 1A-A): ERCW Pump A-A and ERCW Pump C-A
- Unit 1 Train B (6.9kV Shutdown Board 1B-B): ERCW Pump E-B and ERCW Pump G-B
- Unit 2 Train A (6.9kV Shutdown Board 2A-A): ERCW Pump B-A and ERCW Pump D-A
- Unit 2 Train B (6.9kV Shutdown Board 2B-B): ERCW Pump F-B and ERCW Pump H-B

(Pump allocation shown is based on the new configuration per DCN 53785.)

Since only one pump can be run on any one of the shutdown boards, "two pumps on the same plant train" means one ERCW pump each on power train 1A & 2A or on power train 1B & 2B.

The post fire safe shutdown analysis (FSSD) demonstrates that given a fire in any plant location at least two ERCW pumps of the same train will be available. Power and control cables for the train A pumps and the train B pumps are routed in separate fire zones except for 757-A24, 737-A1B, and 713-A1B. In these fire zones, cables for at least 2 pumps of one train powered from different 6.9kv Shutdown boards are or will be protected by an Electrical Raceway Fire Barrier System (ERFBS) installed in accordance with TVA's tested and approved process and configurations.

2. FSAR section 8.3.1 describes sharing of the AC Distribution Systems and Standby Power Supplies. For compliance with GDC 5, the following statement is made in FSAR Amendment 95:

"Therefore, there are electric motors powered by the onsite distribution system of one unit that drive safety-related machinery (i.e., essential raw cooling water pumps, component cooling system pumps) required for safe shutdown of the other unit. For example, the ERCW system is arranged in two headers (trains) each serving certain components in each unit (see Section 9.2.1.2). There are eight ERCW pumps arranged electrically so that two pumps are fed from each shutdown board (1A-A, 1B-B, 2A-A, 2B-B). Only one pump per board can be automatically loaded on a DGU at any one time. The pumps supplied from the 'A' boards pump into the 'A' train header and likewise the 'B' pumps."

Assuming that the operability of a ERCW pump will be dependent on operability of corresponding available power source(s) (power and control power), provide details on the minimum number of power supplies (emergency diesel generators) and corresponding ERCW pump/isolation valve combination required to be operable at all times to ensure that safe shutdown can be achieved on the unit with an accident and the non-accident unit assuming a simultaneous, worst case single failure (including false or spurious accident signal) on each unit. Provide same level of details for the component cooling system pump combination.

Response: a. Essential Raw Cooling Water (ERCW) System

As stated in Unit 2 FSAR Section 9.2.1.3, the minimum combined safety requirements for one accident unit and one non-accident unit or two non-accident units are met by two pumps on the same plant train. There are four emergency diesel generators (DG), one DG supplying power to only one power train of one unit. Although each power train has two ERCW pumps, credit is taken for only one pump due to loading limitations on the associated DG. Watts Bar is capable of mitigating an accident in one unit and safely shutting down the other unit with or without offsite power and a total loss of either header. A total loss of one plant shutdown power train will not prevent safe shutdown of either unit under any credible plant condition. Due to the shared ERCW system, only one of the redundant power trains per plant can be taken out for maintenance or can be tested at a time (See compliance to position C2 of RG 1.81 in Unit 2 FSAR Section 8.1.).

The ERCW System is divided into two Trains: "A" and "B." The two independent ERCW trains are designed with duplicate safety-related mechanical and electrical components physically separated. Power to various components is provided from the four shutdown power trains (1A and 2A or 1B and 2B) each of which is powered by a separate DG on loss of offsite power. The control power to power train A (both Units 1 and 2) is supplied from 125V Vital Batteries I and III. Similarly control power to train B (both Units 1 and 2) is supplied from 125V Vital Batteries II and IV. Loss of control power to one plant train will not prevent the remaining plant train from performing its intended function. Each DG has its own dedicated 125V battery for control power.

In accident scenarios, either the “A” or the “B” Train of electrical power is assumed to be lost. This leaves four ERCW pumps on the remaining train. As there are only two DGs remaining that are capable of supplying power to two of the four remaining ERCW pump motors, there remains two operable ERCW pumps. The DG to ERCW Pump Motor alignment is as noted below:

ERCW Pump	Diesel Generator
A-A	1A
B-A	2A
C-A	1A
D-A	2A
E-B	1B
F-B	2B
G-B	1B
H-B	2B

During normal operation with power available to both trains of ERCW, the ERCW headers are aligned as follows (Note: CCS Heat Exchanger A is in CCS Train 1A; CCS Heat Exchanger B is in CCS Train 2A and CCS Heat Exchanger C is in common CCS Trains 1 & 2 B):

ERCW Train	ERCW Header	CCS Train	CCS Heat Exchanger
A	1A	N/A	N/A
A	2A	2A	B
B	1B	1A	A
B	2B	1B & 2B	C

For operation with Loss-of-Train A power, the alignment is similar to that indicated above:

ERCW Train	ERCW Header	CCS Train	CCS Heat Exchanger
A	1A	N/A	N/A
A	2A	N/A	N/A
B	1B	1A	A
B	2B	1B & 2B	C

For operation with a Loss-of-Train B power or Loss of ERCW Header 1B flow (as detected by high CCS outlet temperature from the A CCS Heat Exchanger), the ERCW supply automatically re-aligns, as follows:

ERCW Train	ERCW Header	CCS Train	CCS Heat Exchanger
A	1A	N/A	N/A
A	2A	1A & 2A	A & B
B	1B	N/A	N/A
B	2B	N/A	N/A

b. Component Cooling System (CCS)

The CCS is a closed-loop, two train system designed to meet single failure requirements. Two independent Trains (A and B) are powered from separate and redundant power supplies. The CCS design has sufficient redundancy, separation, and reliability to provide the minimum functional requirements (safety- related) with a single failure in addition to any initiating DBE. Any failure in any one CCS train will not affect the capability of the other train to provide necessary cooling to safety equipment. Both trains of the safeguards (ESF) equipment of both units served by the CCS are normally aligned and supplied with CCS water and will automatically continue to be supplied in a LOCA.

The component cooling system is comprised of five 480V CCS pumps: 1A-A, 1B-B, 2A-A, 2B-B and C-S. Power is supplied to these pumps from 480V shutdown boards as follows:

CCS Pump	Train	Power Supply	Control Power
CCS Pump 1A--A	Train A	480V Shutdown Board 1A1-A	125V Battery Board I
CCS Pump 1B--B	Train B	480V Shutdown Board 1B1-B	125V Battery Board II
CCS Pump 2A--A	Train A	480V Shutdown Board 2A1-A	125V Battery Board III
CCS Pump 2B--B	Train B	480V Shutdown Board 2B1-B	125V Battery Board IV
CCS Pump C-S	Train S	480V Shutdown Board 2B2-B	125V Battery Board IV (Normal)
CCS Pump C-S	Train S	480V Shutdown Board 1A2-A	125V Battery Board I (Alternate)

Upon loss of offsite power, the CCS pumps will be automatically powered from the Emergency Diesel Generators.

During normal full power operation, with all CCS equipment available:

- Pumps 1A-A and 1B-B and Heat Exchanger A are aligned with Unit 1 Train 1A ESF and miscellaneous equipment;
- Pumps 2A-A and 2B-B and Heat Exchanger B are aligned with Unit 2 Train 2A ESF and miscellaneous equipment;
- Pump C-S and Heat Exchanger C are aligned with Unit 1 Train 1B and Unit 2 Train 2B equipment;
- Pump 1B-B is used as additional capacity for Train 1A as required and as a replacement for pumps 1A-A or C-S, if one should be out of service; and
- Pump 2B-B is used as additional capacity for Train 2A as required and as a replacement for pumps 2A-A or C-S, if one should be out of service.

Pump C-S is capable of receiving power from redundant divisions and these components, including raceway and cables, are identified by suffix “S.” The S cables are routed from the transfer device to the motors in separate raceways with no other circuits to maintain divisional separation.

3. FSAR Section 8.1.5.3 documents compliance with Regulatory Guides (RGs) and Institute of Electrical and Electronics Engineers (IEEE) Standards. For compliance with RG 1.81 Rev 1, the FSAR states "Some plant common loads are supplied from Unit 1, channels I and II and other plant common loads are supplied from Unit 2. In no case does the sharing inhibit the safe shutdown of one unit while the other unit is experiencing an accident. All shared systems are sized to carry all credible combinations of normal and accident loads."

Provide details on common loads supplied from each unit including the specific power sources.

Response: Common loads that are shared between the units belong to the common systems. One example of a common system is Essential Raw Cooling Water (ERCW) System. As documented in the response to **RAI 2.**, this system consists of eight pumps. These eight pumps are powered from four 6.9kV shutdown boards with two pumps on each shutdown board 1A-A, 1B-B (Unit 1); 2A-A and 2B-B (Unit 2). Similarly the 125 VDC loads associated with each ERCW pump are fed from channels I and II (Trains 1A and 1B, Unit 1) and channels III and IV (trains 2A and 2B, Unit 2). Another example of a common system and thus common loads associated with it is Component Cooling System (CCS). As described in the response to **RAI 2.**, the five pumps belonging to CCS system are powered from 480V shutdown board 1A1-A, 1B1-B (Unit 1), 2A1-A and 2B1-B (Unit 2). The 125VDC loads associated with each pump are fed from channels I and II (Trains 1A and 1B Unit 1) and channels III and IV (trains 2A and 2B Unit 2). The fifth pump (C-S) is capable of receiving power from redundant divisions. Normal feed for pump C-S is from 480V shutdown board 2B2-B (Unit 2) with alternate feed from 480V shutdown board 1A2-A (Unit 1). Similarly 125VDC power for components associated with pump C-S obtains its normal power from channel IV and alternate feed from channel I.

Air Cleanup Unit (ACU) Subsystem of the Emergency Gas Treatment System (EGTS) is another common system that is safety-related and is shared between both units. Both fans belonging to ACU Subsystem and the relative humidity heaters are fed from redundant trains of Unit 1 480V Control and Auxiliary Building Vent Boards.

Main Control Room (MCR) Air Conditioning Subsystem is a common system and consists of MCR Chillers, MCR Chilled Water Circulating Pumps and MCR Air Handling Units (AHU). MCR Chillers are fed from Unit 1 480V Shutdown Boards 1A2-A and 1B2-B, MCR AHUs and Chilled Water Circulating Pumps are fed from Unit 1 480V Control and Auxiliary Building Vent Boards 1A1-A and 1B1-B.

Control Building Emergency Pressurization Subsystem and Control Building Emergency Air Cleanup Subsystems are common systems and are safety-related. The power to these subsystems is supplied from Unit 1 480V Control and Auxiliary Building Vent Boards 1A1-A and 1B1-B.

Electrical Board Room (EBR) Air Conditioning Subsystem is a common system and consists of EBR Chillers, EBR Chilled Water Circulating Pumps and EBR Air Handling Units (AHU). EBR Chillers are fed from Unit 2 480V Shutdown Boards 2A2-A and 2B2-B, EBR Chilled Water Circulating Pumps are fed from Unit 2 480V Control and Auxiliary Building Vent Boards 2A1-A and 2B1-B. Out of a total of four (4) EBR AHUs, two (2) EBR AHUs are fed from Unit 1 480V Shutdown Boards 1A1-A and 1B1-B and two (2) EBR AHUs are fed from Unit 2 480V Shutdown Boards 2A1-A and 2B1-B.

Auxiliary Control Air subsystem is a common system with two skid mounted compressor units. Compressor A-A is fed from Unit 2 480V Control and Auxiliary Building Vent Board 2A1-A and compressor B-B is fed from Unit 2 480V Control and Auxiliary Building Vent Board 2B1-B.

Auxiliary Building Gas Treatment System (ABGTS) is a common system. ABGTS fans A-A and B-B are fed from Unit 2 480V Control and Auxiliary Building Vent Boards 2A1-A and 2B1-B, respectively.

4. FSAR Section 8.2.1.8 describes Conformance with Standards. For compliance with GDC 17, this section states "The non-1E control power circuits from the vital battery boards to 6.9-kV common switchgear C and D have redundant protection (breaker and fuse) in the event of a failure. Selective coordination exists between the non-1E and Class 1E circuits that are fed from each of the vital battery boards. Thus, failure of all of the non-1E control power circuits on the vital battery boards will not have any effect on the 1E circuits or battery boards."

For all AC (including 480V) and DC circuits that rely on molded case circuit breaker (MCCB) combinations or MCCB and fuse combinations or fuse/fuse combination to provide separation between common circuits or safety/nonsafety-related circuits, describe the protective devices/schemes used in each common or non-1-E circuit and provide coordination curves for the devices. Specifically provide details on the instantaneous region of the protective devices and available fault currents.

Response: <u>125V Vital Battery Boards</u>

Analysis for selective coordination for the 125V Vital DC System is performed in calculation WBNEEBMSTI070005. The battery boards supply non-safety related loads through MCCBs connected to the main bus through fused sub-distribution buses. Safety-related loads and non-safety loads are supplied from separate sub-distribution buses. The fuse/breaker combinations for non-safety load groups are as follows:

125V Vital Battery Board I
0-BD-236-1-D

Fuse (Type)	Largest Down-stream Sub-distribution Breaker
0-FU-236-0001/203-D (FRN-R150)	50A
0-FU-236-0001/205-D (FRN-R100)	30A
0-FU-236-0001/207-D (FRN-R60)	15A

125V Vital Battery Board II
0-BD-236-2-E

Fuse (Type)	Largest Down-stream Sub-distribution Breaker
0-FU-236-0002/203-E (FRN-R150)	50A
0-FU-236-0002/205-E (FRN-R100)	30A
0-FU-236-0002/207-E (FRN-R60)	15A

125V Vital Battery Board III
0-BD-236-3-F

Fuse (Type)	Largest Down-stream Sub-distribution breaker
0-FU-236-0003/203-F (FRN-R-200)	90A
0-FU-236-0003/205-F (FRN-R-100)	30A
0-FU-236-0003/207-F (FRN-R-60)	15A

125V Vital Battery Board IV
0-BD-236-4-G

Fuse (Type)	Largest Down-stream Sub-distribution breaker
0-FU-236-0004/203-G (FRN-R-150)	60A
0-FU-236-0004/205-G (FRN-R-100)	30A
0-FU-236-0004/207-G (FRN-R-60)	15A

The sub-distribution bus fuses are time-delay, Bussmann type FRN, with sizes as indicated in the tables above. The branch circuit breakers are molded-case, thermal-magnetic trip, Cutler-Hammer/Westinghouse type HFB or HFD. The largest fuse/breaker combination for a non-safety related circuit is a 200A sub-distribution bus fuse with a downstream 90A breaker. Characteristics for these devices are shown on time current curves (TCC) 5 and 5A from calculation WBN-EEB-MS-T107-0005 (enclosed OSM includes an electronic version of each). The battery main feed protection is a GE type AK air circuit breaker rated 1000A (800A battery board V) with long and short time delays, and no instantaneous trip, in series with fast-acting current-limiting fuses rated 1600A, Shawmut type A4BY1600. The maximum available short circuit current on a battery board bus was determined in the referenced calculation to be 16,340A. Selective coordination of board branch circuits with the battery main feed protection is shown through depiction of curves with representative, bounding devices. The breaker and fuse configurations considered bound those being placed in service for Unit 2. TCC-7A from calculation WBN-EEB-MS-T107-0005 (enclosed OSM includes an electronic version) depicts the selective coordination of the main feed protection for vital batteries I, II, III and IV with a 200A stub bus fuse and a bounding 300A breaker. TCC-8A from calculation WBN-EEB-MS-T107-0005 (enclosed OSM includes an electronic version) similarly depicts the selective coordination for vital battery board V for when it is connected as a replacement for batteries I - IV.

<u>125V Vital DC Cascade Fuses</u>

The calculation also includes a review for identification and analysis of fuses which would be used to isolate non-safety related portions of safety-related control circuits. Schematics and wiring diagrams of control circuits supplied by the 125V Vital DC power system were reviewed to identify such fuses which were then analyzed to verify selective coordination with upstream protective devices. The following is a representative analysis of a Unit 2 cascade fuse application not previously in service for Unit 1:

Fuse set 2-FU-212-B23/13-B is used to isolate the non-safety related portion of the breaker shunt trip control circuit for Unit 2 Reactor Building Crane 2-CRN-271-R1 from a safety-related circuit used to load shed non-safety loads supplied from a safety-related motor control center. The circuit is supplied by Vital DC control power from 480V Shutdown Board 2B2-B. The 3A Bussmann KTN-R-3 fuses used to isolate the non-required portion of the circuit coordinate selectively with the upstream 10A Bussmann KWN-R-10 dc control bus fuses as demonstrated curve TCC-12B from calculation WBN-EEB-MS-T107-0005 (enclosed OSM includes an electronic version).

<u>120V Vital AC Distribution Boards</u>

Analysis for selective coordination for the 120V Vital AC system is performed in calculation WBNEEBMSTI070018. The distribution boards supply non-safety related loads through MCCBs connected to the main bus through fused sub-distribution buses.

Safety-related loads and non-safety related loads are supplied from separate sub-distribution buses. The sub-distribution bus fuses are time-delay, Bussmann type FRN-R, rated 70A. The branch circuit breakers are molded-case, hydraulic-magnetic trip, Heinemann C series, rated 15A curve type 3 or 1, or 25A curve type 3. The vital inverter system output is protected by a fast-acting fuse, Bussmann type KTN-R, rated 250A. The maximum steady-state short circuit current available from the inverter system is determined in the referenced calculation to be 301A. Curves TCC-5, TCC-6, and TCC-7 from calculation WBN-EEB-MS-T107-0018 (enclosed OSM includes electronic versions) depict selective coordination of the inverter output fuse with the sub-distribution bus fuse and selective coordination of sub-distribution bus fuses with branch circuit breakers.

<u>120V Vital AC Cascade Fuses</u>

The calculation also includes a review for identification and analysis of fuses which would be used to isolate non-safety related portions of safety-related control circuits. Schematics and wiring diagrams of control circuits supplied by the 120V Vital AC power system were reviewed to identify such fuses which were then analyzed to verify selective coordination with upstream protective devices. The following is a representative analysis of a Unit 2 cascade fuse application not previously in service for Unit 1:

Fuses 2-FU-276-L26D/7 and 8 are used to isolate non-safety related instruments 2-TIC-067-109 and 2-TM-067-109 from the safety portion of the 120V Vital AC supply to Auxiliary Building Instrument Bus B instrumentation located on local panel 2-L-26, ERCW TO LWR CNTMT VENT, RC PMP & CONT ROD DRIVE CLRS. The circuit is supplied by 120VAC Vital Distribution Board 2-IV, breaker 26. The 1A Bussmann KWN-R-1 fuses used to isolate the non-safety portion of the circuit coordinate selectively with the upstream 15A, Heinemann curve 3, circuit breaker as demonstrated in curve TCC-9 from calculation WBN-EEB-MS-T107-0018 (enclosed OSM includes electronic versions).

<u>480V Motor Control Centers (C & A Vent Boards, Diesel Auxiliary Boards, Reactor MOV Boards and Reactor Vent Boards)</u>

Analysis for selective coordination for the Class 1E 480V motor control centers (MCC) is performed in calculations WBN-EEB-MS-TI08-0008 and EDQ00299920080004. The MCCs supply non-safety related loads through MCCBs mounted in compartments and plugged into the main bus. The MCCBs are thermal-magnetic trip or magnetic-only motor circuit protectors used in conjunction with combination motor starters. They are ITE type EF3 or FJ6, or Siemens type ED63 or FXD63, in various trip ratings. The MCC main feeds and buses are protected by Westinghouse type DS-206 or 416 switchgear breakers located on the 480V Shutdown Boards. The MCC feeder breakers have Amptector type 1-A sensors, with long and short time delays and no instantaneous trip. The discriminator circuits which would provide instantaneous protection above 12-times sensor rating are bypassed for breakers supplying MCC feeders in order to assure selective coordination. Only the normal MCC feeders are credited for operability. Selective coordination is demonstrated in the referenced calculations using bounding configurations. Curve TCC-III-2 from calculation WBN-EEB-MS-TI08-0008 (enclosed OSM includes electronic version) is applicable to 480V Diesel Auxiliary Boards which have a maximum available short circuit current of 7146A. Curve from calculation EDQ00299920080004, Appendix 3.1, (enclosed OSM includes electronic version) is applicable to 480V C & A Vent Boards, Reactor MOV Boards and Reactor Vent Boards which have a maximum available short circuit current of 17329A. These curves demonstrate selective coordination for the largest breakers applicable for a Unit 2 MCC non-safety related load. The maximum available short circuit amps are from Auxiliary Power System Analyses WBN-EEB-ED-Q000-999-2007-0002, Attachment 11.3.e (enclosed OSM includes electronic version).

<u>480V Shutdown Boards</u>

Analysis for selective coordination for the Class 1E 480V Shutdown Boards is performed in calculation WBNEEBMSTI080008. The Shutdown Boards supply non-safety related loads through Westinghouse type DS-206 or 416 switchgear breakers with Amptector type 1-A sensors. The non-safety related loads supplied from the Unit 2 Shutdown Boards, consist of motor loads, a battery charger alternate feeder and the emergency feeder for 480V Auxiliary Common Board B. The breakers have instantaneous and long time elements except for the board feeder which has long time and short time elements with no instantaneous element. The Shutdown Board main feeds are supplied through Westinghouse type DS-632 non-automatic breakers with protection provided by Westinghouse/ABB CO-8 time over-current relays. Selective coordination is demonstrated in the referenced calculation using bounding configurations. Curves TCC-III-2 and TCC-III-5 from calculation WBN-EEB-MS-TI08-0008 (enclosed OSM includes electronic versions) demonstrate selective coordination for breaker sizes and settings bounding that applicable for a Unit 2 Shutdown Board non-safety related load. The maximum available short circuit amps for a Unit 2 Shutdown Board 3200-amp bus is 41,497A based on Auxiliary Power System Analyses WBN-EEB-ED-Q000-999-2007-0002, Attachment 11.3.e (enclosed OSM includes electronic version).

5. The FSAR Amendment 95 identifies cable splices in underground cable and low voltage power and control cable installations and penetrations. Position 9 of RG 1.75 states that cable splices in raceways should be prohibited. The NRC staff's prohibition against splices in raceways is centered on the prevention of fires caused by improper splices. Position 9 of RG 1.75 (Rev 2), states that if cable splices exist, the resulting design should be justified by analysis and that the analyses should be submitted as part of the safety analysis report. The NRC staff's review of the FSAR Amendment 95 and 97 did not find the necessary information for justifying splices in the cables that are being replaced for startup of WBN 2.

In order to evaluate the use of splices in the new cables in raceways being installed for startup of WBN 2, provide additional information on the analysis/justification for use of splices in accordance with Position 9 of RG 1.75, which demonstrates compliance with the requirements of GDCs 2, 4, and 17.

Response: As stated in section 8.1.5.3 of the FSAR, Regulatory Guide 1.75 was issued after the Watts Bar design was complete.

Splices at WBN are made using nuclear qualified material only. The qualification of the material is documented in Environmental Qualification Documentation Package (EQDP) for splice material. The EQDP provides manufacturer's instructions for splice configuration. These EQDPs are available for NRC inspection.

Unit 2 has not installed any splices in raceways (conduit or tray) on the new cables that are being installed for startup of Unit 2.

6. In FSAR Amendment 95, Section 8.3.1.4.2 identifies fire resistance barriers installed between redundant division trays (open and enclosed trays) to maintain separation between them. The effects on cable ampacity due to environmental conditions and cable installation configuration are discussed in Section 8.3.1.4.1. The NRC staff's review of these two sections did not identify a description of the fire barriers or information on the effects of fire barriers on cable ampacity.

Provide additional information on the type of fire barriers and information on its effect on cable ampacity (derating) for the new cables being installed or replaced for startup of WBN 2.

Response: TVA design standard for auxiliary and control power cable sizing specifies TSI fire wrap and 3M fire wrap material as approved materials to be used as fire barriers. The following table identifies the material type, the configuration where it is applied and the Ampacity Correction Factors (ACF) to be applied to the cables that are wrapped:

Cable Ampacity Correction Factors for TSI Fire Wrap

TSI Material	Configuration	ACF
330-1	Single conduit with 5/8 inch or with 3/8 inch +3/8 inch	0.93
330-1	Single conduit with 5/8 inch +3/8 inch	0.92
330-1	Multiple conduits in a common enclosure, 5/8 inch panels directly on the conduit, no Unistrut frame	0.74
330-1	Multiple conduits in a common enclosure, 5/8 inch panels on a Unistrut frame	0.88
330-1	Single tray or side-by-side trays in a common enclosure with 5/8 inch panels	0.68
330-1	Multiple trays in a vertical stack in a common enclosure, 5/8 inch panels	0.59
330-1	Air drop 5/8 inch +3/8 inch	0.68
330-660	Air drop - 3 wraps	0.68
330-1 / 770-1 (3 hour)	Conduit - **2 inch and larger**: 1.25 inch base 330-1 layer covered with two layers of pre-buttered 3/8 inch 770-1	0.82
330-1 / 770-1 (3 hour)	Tray - 1.25 inch base 330-1 layer covered with two layers of pre-buttered 3/8 inch 770-1	0.52

Cable Ampacity Correction Factors for 3M Fire Wrap Material

Material	Configuration	ACF
M-20A (1 hour)	Air drop: 5 layers	0.51
M-20A (1 hour)	Conduit: 5 layers	0.62
M-20A (1 hour)	Tray: 4 layers	0.40
CS-195 / M-20A (1 hour)	Tray: 1 layer CS-195 and 1 layer M-20A	0.40

7. Section 8.3.1.4.3 of the FSAR Amendment 95 (page 8.3-48) states that cables for nonsafety-related functions are not run in conduit used for essential circuits except at terminal equipment where only one conduit entrance is available. Also, FSAR Amendment 95 (page 8.3-49) states that a nonsafety-related cable may be routed with those for essential circuits provided that the cable or any cable in the same circuit has not been subsequently routed onto another tray containing a different division of separation of essential cables.

Provide a clarification of the above statements since they appear to be contradictory.

Response: The referenced portion of Section 8.3.1.4.3 of FSAR Amendment 95 (page 8.3-48) addresses requirements specifically applicable to conduit installations. Separation requirements for conduits prohibit the routing of non-safety related cables in safety-related conduits except at terminal equipment where only one conduit entrance is provided. In such cases, the non-safety cable is required to be separated as soon as possible after it leaves the equipment such that the balance of its conduit route is separate. A typical example of such an application would be a limit switch wherein one contact is used for a control function in a safety-related circuit and another contact is used for a non-safety related alarm function. For this example, the alarm cable is both non-safety related and a different voltage level.

The referenced statement on page 8.3-49 of Section 8.3.1.4.3 addressing routing of non-safety related cables with essential cables pertains to cable tray installations. Separation requirements for trays permit routing of non-safety related cables in safety-related trays; however, doing so requires that they be treated as associated circuits and once associated must not be routed in trays (or other raceways) of a redundant separation group. For this situation, the voltage level for the non-safety related cable would be compatible with the safety-related cables in the tray. Requirements imposed on associated circuits are discussed further in the subsequent FSAR paragraphs.

8. In the original Safety Evaluation Report (NUREG 0847), the NRC staff concluded that a nonsafety-related cable must be treated as an associated cable if it was routed with essential circuits. An associated cable should only be routed with its associated safety related cables and be separated from other nonsafety-related cables as well as the redundant safety related cables. Thus the independence-of redundant cable systems cannot be compromised through the non-safety related cables sharing a common raceway. Any new nonsafety-related cables being installed or replaced for startup of WBN 2 and sharing a raceway with essential circuits should meet the guidelines of positions 4, 6, and 7 of RG 1.75 and Sections 4.5 and 4.6.2 of IEEE Standard 384-1974.

Provide an analysis of associated circuits for the new cables being installed or replaced for startup of WBN 2 in accordance with Section 4.6.2(1) of IEEE Standard 384-1974. The analysis should demonstrate that electrical faults, caused by failure of the associated cables, will not compromise the independence of redundant safety related cable systems. The analysis should verify that the cable's associated protective device will clear the imposed fault condition (in an acceptable time period) without exceeding the I^2t rating for the cable and without tripping the upstream breaker supplying the safety bus. The analysis should include sample coordination curves of the protective devices for each voltage level to show that a fault in the associated circuit will not result in a loss of the safety bus or the loss of redundant safety related cables.

Response: The analytical approach used by TVA WBN for protection of associated circuits is to consider all non-1E power and control cables (NV-3, 4, 5) routed in Category 1 structures to be potentially associated and to verify that each cable has thermal damage protection as described in FSAR Section 8.1.4.3. The analysis includes cables that originate from power sources located within the Category 1 structures as well as those that originate from power sources external to the Category 1 structures. The analysis is performed in several calculations based on voltage level and supply source:

- WBPEVAR9001007, MEDIUM VOLTAGE APPENDIX R AND REG. GUIDE 1.75 ASSOCIATED CIRCUITS ANALYSIS
- WBNEEBMSTI150011, 480V NON-CLASS 1E POWER CABLE ASSOCIATED CIRCUITS
- WBPEVAR9001006, REG. GUIDE 1.75 ASSOCIATED CIRCUITS AND APPENDIX R ANALYSIS FOR NON-CLASS 1E 120VAC & 250V DC CIRCUITS
- WBNEEBMSTI070005, 125V DC PROTECTION AND COORDINATION CALCULATION
- WBNEEBMSTI070018, 120VAC PROTECTION, COORDINATION AND SHORT CIRCUIT STUDY

Cable protection is demonstrated through time-current plots which compare the protective device characteristics with applicable cable thermal damage curves. In some cases, credit is taken for equivalency to UL 489 breaker/cable combinations for configuration acceptance.

Circuit breakers acting as the sole protective device for a potentially associated cable are identified in the referenced calculations for incorporation into a periodic testing program. Selective coordination for non-safety related loads supplied from safety-related boards is addressed in response to **RAI 4.** above. The following provide representative applications that display considerations for cable thermal damage protection (enclosed OSM includes electronic versions):

- Excerpt from Calculation WBPEVAR9001007 for: 6.9kV RCP feeder cable protection;
- Excerpt from Calculation WBNEEBMSTI150011 for: 480VAC Pressurizer Heater, typical MCC load, and 480V TSC Inverter and Regulating Transformer feeder cables;
- Excerpt from Calculation WBNEEBMSTI150011 for: 480VAC circuit breaker tabulation for evaluation of periodic breaker testing requirements;
- Excerpt from Calculation WBPEVAR9001006 for: 250VDC and 120VAC non-1E source typical cable protection;
- Excerpt from Calculation WBPEVAR9001006 for: Summary table for identification of minimum cable sizes for various protective devices used in typical non-1E control power source applications;
- Excerpt from Calculation WBNEEBMSTI070005 for: 125VDC Vital Battery Board typical non-1E circuit cable protection; and
- Excerpt from Calculation WBNEEBMSTI070018 for: 120VAC Vital Distribution Board typical non-1E circuit cable protection.

ENCLOSURE 1

Response to RAIs Regarding Unit 2 FSAR

Tennessee Valley Authority - Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

RAIs for FSAR 2.3.1.3, 2.3.2, 4.2, and 5.2.2 [taken from NRC letter dated 08/11/2010 (ADAMS Accession No. ML102180055):

Section 2.3.1.3, Severe Weather

2.3.1.3 - 1. The annual probability of tornadoes with winds exceeding 113 miles per hour in the vicinity of the Watts Bar site is given as 2.69×10^{-4} per square mile. NRC staff has estimated another probability based upon default information in Figure 2-2 of NUREG/CR-4461, Revision 2, "Tornado Climatology of the Contiguous United States," for the Watts Bar area. Please provide further information describing your calculation to show how the value of 2.69×10^{-4} per square mile was obtained.

Response: When calculating the probability, the value in Figure 2-2 of NUREG/CR-4461was incorrectly read as 20 instead of the correct value of 28. Using the correct value and recalculating the probability provides a value of "3.77×10^{-4} per square mile."

Amendment 101 to the Unit 2 FSAR will replace "2.69×10^{-4} per square mile" with "3.77×10^{-4} per square mile."

2.3.1.3 - 2. Amendment No. 99 provides data for the 1995 through 2009 period in which high wind speeds of short duration were measured in 3-second intervals. Record high wind speeds of short duration, measured as fastest mile wind speeds that were discussed in prior FSAR amendments, were not carried forward or otherwise discussed in Amendment No. 99 and, therefore, the historic period of record presented in the FSAR may appear to be incomplete. Therefore, provide a discussion of the record historical measurements of both fastest mile and three-second gust wind speeds or reference appropriate sections in the FSAR amendment where engineering analysis demonstrates the maximum historical short duration winds speeds, whether based upon fastest mile or 3-second gust, have been considered in the design of Watts Bar, Unit 2.

Response: Wind records were expanded to include the information in prior FSAR amendments for Chattanooga and Knoxville. All data was then converted to 3-second gust equivalents so extreme cases could be identified.

Amendment 101 to the Unit 2 FSAR will provide a new Table 2.3-1A (Extreme Wind Speeds) that captures this data. Addditionally, applicable text will be revised to identify the highest observed wind in units equivalent to 3-second gusts.

2.3.1.3 - 3. With regard to winds equal to or greater than 50 knots reported during 1950 through 2009, how many occurrences were reported in each of the seven counties? Is each total for the entire county or were criteria applied to consider only portions of any of the counties? If criteria were applied, what is the basis for selection of the criteria?

Response: High wind speed records reflect the entire county in all cases. A new search of the NCDC Storm Event database was conducted on a county-by-county basis.

Amendment 101 to the Unit 2 FSAR will provide a new Table 2.3-1B (Storm Events and Surrounding Counties) that identifies search criteria and results. Additionaly, applicable text will be revised to reflect the results of this search and the new table.

2.3.1.3 - 4. With respect to hail three-fourths of an inch in diameter or larger reported during 1950 through 2009, how many occurrences were reported in each of the seven counties? Is each total for the entire county or were criteria applied to consider only portions of any of the counties? If criteria were applied, what is the basis for selection of the criteria?

Response: Large hail (i.e., ≥ 0.75 inch in diameter) records reflect the entire county in all cases. A new search of the NCDC Storm Event database was conducted on a county-by-county basis.

Amendment 101 to the Unit 2 FSAR will provide a new Table 2.3-1B (Storm Events and Surrounding Counties) that identifies search criteria and results. Additionaly, applicable text will be revised to reflect the results of this search and the new table. Note that the older references to number of hail days for Chattanooga and Knoxville were retained because they reflect the frequency of occurrence at a specific location within the county.

2.3.1.3 - 5. Provide an example of how the seasonal densities of lightning flashes to ground per square kilometer were estimated from FSAR Table 2.3.1.

Response: Amendment 101 to the Unit 2 FSAR will provide additional text to explain how the seasonal values were estimated. This amendment will also correct a rounding error for the winter season value (i.e., replace “0.54” with “0.55”).

2.3.1.3 - 6. Why was the single storm snowfall record for Knoxville, Tennessee (TN) of 22.5 inches in Amendment No. 93 replaced by 15 inches in subsequent FSAR amendments? Why was the value of 22.5 inches used to calculate the weight of snow per square foot in Amendment No. 93 retained in subsequent FSAR amendments rather than being replaced by the single storm value for Chattanooga, TN of 47 inches?

Response: The snowfall records were incorrectly stated in Amendment 93. The Knoxville single storm record of 22.5 inches occurred prior to establishment of the current Knoxville NWS station, and it was not reflected in the summary for the current station.

The Chattanooga single storm value of 47 inches shown in the FSAR is incorrect. This value was obtained from a maximum snow depth value that was itself in error. Specifically, the 2009 Annual Local Climatological Data (LCD) report for Chattanooga identified a historical maximum snow depth of 47 inches occurring in January 1948. However, the original January 1948 Chattanooga monthly LCD reported a maximum snow depth of 4.7 inches. Therefore, the 22.5 inch value for Knoxville is the proper value for subsequent calculations. Amendment 101 to the Unit 2 FSAR will reflect the correct information and will improve the snow load discussion.

<u>Section 2.3.2, Local Meteorology</u>

2.3.2 - 7. Several of the historic record values for Decatur, TN in FSAR amendments prior to Amendment No. 94 appear to be more limiting than values measured in more recent years following movement of the National Oceanic and Atmospheric Administration measurement site from Decatur to Dayton, TN. However, the limiting Decatur values were not carried forward or otherwise addressed in Amendment No. 99. As a result, the summary historic record presented in the FSAR may appear to be incomplete. Therefore, in the next FSAR amendment, discuss the entire period of historic measurements. Confirm that the Decatur data were considered and that the limiting values have been identified.

Response: The Dayton and Chattanooga temperature data is used to describe the climatological normal temperature conditions, but the Decatur data establishes the extreme temperature conditions since it exceeds both Dayton and Chattanooga for both the extreme maximum and extreme minimum.

Amendment 101 to the Unit 2 FSAR will restore the Decatur, TN temperature data to Table 2.3.2 (side-by-side with the Dayton, TN temperature data). Additionally, the FSAR text is being revised to discuss temperature data from all three locations.

2.3.2 - 8. With regard to mean temperatures, the text of FSAR Section 2.3.2.2 states that certain value ranges occurred at both of two locations, Dayton and Chattanooga, TN. Although the differences are small, information provided in FSAR Tables 2.3-2 and 2.3-3 indicate that the values cited in the text tended to occur at only one of the locations. Therefore, it would seem appropriate to modify the text in the next FSAR amendment to provide a range that includes both locations or reword to facilitate deletion of "at both locations," as appropriate.

Response: Amendment 101 to the Unit 2 FSAR will clarify the mean temperature information. The “at both locations” phrase has been deleted and mean temperature data is now presented as a range that represents both locations.

ENCLOSURE 2

List of Files Provided on Enclosed Optical Storage Media (OSM)

Tennessee Valley Authority - Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

File Name		FileSize (Bytes)
01 - Attachment 1:	CAW-10-2890: Application For Withholding Proprietary Information From Public Disclosure	2,684,321
02 - Attachment 2:	WCAP-16501-P, Revision 0: Extension of Turbine Valve Test Frequency Up to 6 Months for BB-296 Siemens Power Generation (Westinghouse) Turbines with Steam Chests (Proprietary)	14,513,863
03 - Attachment 3:	WCAP-16501-N, Revision 0: Extension of Turbine Valve Test Frequency Up to 6 Months for BB-296 Siemens Power Generation (Westinghouse) Turbines with Steam Chests (Non-Proprietary)	2,416,258
04 - Attachment 4:	TI-227, Revision 3: Turbine Integrity Program with Turbine Overspeed Protection (TIPTOP)	109,136
05 - Attachment 5:	WB2-TJM-046: Siemens Authorization TJM-046 for TVA to Distribute Siemens Nuclear HP Turbine Missile Report EC-02262 to the NRC for Use and Publication TVA Watts Bar #2 Completion, Upgrade & Startup Project	94,515
06 - Attachment 6:	EC-02262, December 17, 2002: Missile Generation Risk Assessment for Original and Retrofit Nuclear HP Rotors	601,174
07 - Attachment 7:	Supporting Information for RAI 4 [Taken from NRC letter dated 08/09/2010 (ADAMS Accession No. ML1018706820)]	1,685,365
08 - Attachment 8:	Supporting Information for RAI 8 [Taken from NRC letter dated 08/09/2010 (ADAMS Accession No. ML1018706820)]	1,372,419
09 – Attachment 9	Supporting Information for RAI 15.5 – 1.	25,031,828

ENCLOSURE 3

List of New Regulatory Commitments

Tennessee Valley Authority - Watts Bar Nuclear Plant - Unit 2, Docket No. 50-391

1. Amendment 101 to the Unit 2 FSAR will implement changes as noted in the applicable responses.

2. Calculation WCG-1-2010 will be revised to include the Unit 2 Polar Crane as a Single Failure Proof Equivalent per Chapter 3 of NEI 08-05 by October 29, 2010.

3. The new Unit 2 FSAR Section 3.12 will be submitted to the NRC by November 24, 2010.