



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 17, 2015

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3R-C
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 - ISSUANCE OF AMENDMENT
REGARDING MODIFICATION TO TECHNICAL SPECIFICATION 3.8.1
REGARDING DIESEL GENERATOR STEADY STATE FREQUENCY
(TAC NO. MF6153)

Dear Mr. Shea:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 102 to Facility Operating License No. NPF-90 for the Watts Bar Nuclear Plant, Unit 1. This amendment consists of a change to Technical Specification (TS) 3.8.1 regarding the diesel generator (DG) steady-state frequency in response to your application dated April 6, 2015, as supplemented by letter dated July 15, 2015. The amendment would revise the acceptance criteria for the DG steady-state frequency range provided in several TS Surveillance Requirements.

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice. If you have any questions regarding this letter, please contact me at (301) 415-1349.

Sincerely,

A handwritten signature in cursive script that reads "Jeanne A. Dion".

Jeanne A. Dion, Project Manager
Watts Bar Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosures:

1. Amendment No. 102 to NPF-90
2. Safety Evaluation

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-390

WATTS BAR NUCLEAR PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 102
License No. NPF-90

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by the Tennessee Valley Authority (TVA or the licensee) dated April 6, 2015, as supplemented by letter dated July 15, 2015, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

Enclosure 1

2. Accordingly, the license is amended as indicated in the attachment to this license amendment.

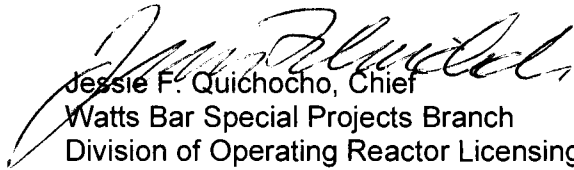
Paragraph 2.C.(2) of Facility Operating License No. NPF-90 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A as revised through Amendment No. 102 and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this license. TVA shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance, and shall be implemented after the issuance of the Facility Operating License for Watts Bar Nuclear Plant, Unit 2.

FOR THE NUCLEAR REGULATORY COMMISSION


Jessie F. Quichocho, Chief
Watts Bar Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Operating License

Date of Issuance: ~~September~~ 17, 2015

ATTACHMENT TO LICENSE AMENDMENT NO. 102

FACILITY OPERATING LICENSE NO. NPF-90

DOCKET NO. 50-390

Replace Page 3 of Operating License NPF-90 with the attached Page 3.

Replace the following pages of the Appendix A Technical Specifications with the attached pages. The revised pages are identified by amendment number and contain vertical lines indicating the area of change.

Remove Pages

3.8-6
3.8-8
3.8-9
3.8-10
3.8-11
3.8-13
3.8-15
3.8-16

Insert Pages

3.8-6
3.8-8
3.8-9
3.8-10
3.8-11
3.8-13
3.8-15
3.8-16

- (4) TVA, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required, any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis, instrument calibration, or other activity associated with radioactive apparatus or components; and
 - (5) TVA, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.
- C. This license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect, and is subject to the additional conditions specified or incorporated below.
- (1) Maximum Power Level

TVA is authorized to operate the facility at reactor core power levels not in excess of 3459 megawatts thermal.
 - (2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A as revised through Amendment No. 102 and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this license. TVA shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.
 - (3) Safety Parameter Display System (SPDS) (Section 18.2 of SER Supplements 5 and 15)

Prior to startup following the first refueling outage, TVA shall accomplish the necessary activities, provide acceptable responses, and implement all proposed corrective actions related to having the Watts Bar Unit 1 SPDS operational.
 - (4) Vehicle Bomb Control Program (Section 13.6.9 of SSER 20)

During the period of the exemption granted in paragraph 2.D.(3) of this license, in implementing the power ascension phase of the approved initial test program, TVA shall not exceed 50% power until the requirements of 10 CFR 73.55(c)(7) and (8) are fully implemented. TVA shall submit a letter under oath or affirmation when the requirements of 73.55(c)(7) and (8) have been fully implemented.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	Verify correct breaker alignment and indicated power availability for each offsite circuit.	7 days
SR 3.8.1.2	<p>-----NOTES-----</p> <ol style="list-style-type: none"> 1. Performance of SR 3.8.1.7 satisfies this SR. 2. A modified DG start involving idling and gradual acceleration to synchronous speed may be used for this SR as recommended by the manufacturer. When modified start procedures are not used, the time, voltage, and frequency tolerances of SR 3.8.1.7 must be met. <p>-----</p> <p>Verify each DG starts from standby conditions and achieves steady state voltage ≥ 6800 V and ≤ 7260 V, and frequency of 60 Hz nominal.</p>	As specified in Table 3.8.1-1

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.7	Verify each DG starts from standby condition and achieves in ≤ 10 seconds, voltage ≥ 6800 V, and frequency ≥ 58.8 Hz. Verify after DG fast start from standby conditions that the DG achieves steady state voltage ≥ 6800 V and ≤ 7260 V, and frequency ≥ 59.8 Hz and ≤ 60.1 Hz.	184 days
SR 3.8.1.8	<p>-----NOTE-----</p> <p>For the 1A-A and 1B-B Shutdown Boards, this Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR.</p> <p>-----</p> <p>Verify automatic and manual transfer of each 6.9 kV shutdown board power supply from the normal offsite circuit to each alternate offsite circuit.</p>	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.9</p> <p>-----NOTES-----</p> <p>1. For DGs 1A-A and 1B-B, this Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR.</p> <p>2. If performed with the DG synchronized with offsite power, it shall be performed at a power factor ≥ 0.8 and ≤ 0.9.</p> <p>-----</p> <p>Verify each DG rejects a load greater than or equal to its associated single largest post-accident load, and:</p> <p>a. Following load rejection, the frequency is ≤ 66.75 Hz;</p> <p>b. Within 3 seconds following load rejection, the voltage is ≥ 6555 V and ≤ 7260 V; and</p> <p>c. Within 4 seconds following load rejection, the frequency is ≥ 59.8 Hz and ≤ 60.1 Hz.</p>	<p>18 months</p>
<p>SR 3.8.1.10</p> <p>-----NOTE-----</p> <p>For DGs 1A-A and 1B-B, this Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR.</p> <p>-----</p> <p>Verify each DG operating at a power factor ≥ 0.8 and ≤ 0.9 does not trip and voltage is maintained ≤ 8880 V during and following a load rejection of ≥ 3960 kW and ≤ 4400 kW and ≥ 2970 kVAR and ≤ 3300 kVAR.</p>	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.11</p> <p>-----NOTE----- For DGs 1A-A and 1B-B, this Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. -----</p> <p>Verify on an actual or simulated loss of offsite power signal:</p> <ul style="list-style-type: none"> a. De-energization of emergency buses; b. Load shedding from emergency buses; c. DG auto-starts from standby condition and: <ul style="list-style-type: none"> 1. energizes permanently connected loads in ≤ 10 seconds, 2. energizes auto-connected shutdown loads through automatic load sequencer, 3. maintains steady state voltage ≥ 6800 V and ≤ 7260 V, 4. maintains steady state frequency ≥ 59.8 Hz and ≤ 60.1 Hz, and 5. supplies permanently connected and auto-connected shutdown loads for ≥ 5 minutes. 	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.12</p> <p>-----NOTE----- This Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR. -----</p> <p>Verify on an actual or simulated Engineered Safety Feature (ESF) actuation signal each Unit 1 DG auto-starts from standby condition and:</p> <ul style="list-style-type: none"> a. In ≤ 10 seconds after auto-start and during tests, achieves voltage ≥ 6800 V and frequency ≥ 58.8 Hz; b. After DG fast start from standby conditions the DG achieves steady state voltage ≥ 6800 V and ≤ 7260 V, and frequency ≥ 59.8 Hz and ≤ 60.1 Hz. c. Operates for ≥ 5 minutes; d. Permanently connected loads remain energized from the offsite power system; and e. Emergency loads are energized from the offsite power system. 	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.15</p> <p>-----NOTE----- This Surveillance shall be performed within 5 minutes of shutting down the DG after the DG has operated ≥ 2 hours loaded ≥ 3960 kW and ≤ 4400 kW.</p> <p>Momentary transients outside of load range do not invalidate this test.</p> <p>-----</p> <p>Verify each DG starts and achieves, in ≤ 10 seconds, voltage ≥ 6800 V, and frequency ≥ 58.8 Hz. Verify after DG fast start from standby conditions that the DG achieves steady state voltage ≥ 6800 V and ≤ 7260 V, and frequency ≥ 59.8 Hz and ≤ 60.1 Hz.</p>	<p>18 months</p>
<p>SR 3.8.1.16</p> <p>-----NOTE----- For DGs 1A-A and 1B-B, this Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR.</p> <p>-----</p> <p>Verify each DG:</p> <ul style="list-style-type: none"> a. Synchronizes with offsite power source while loaded with emergency loads upon a simulated restoration of offsite power; b. Transfers loads to offsite power source; and c. Returns to ready-to-load operation. 	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.19</p> <p>-----NOTE----- For DGs 1A-A and 1B-B, this Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. -----</p> <p>Verify on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ESF actuation signal:</p> <ul style="list-style-type: none"> a. De-energization of emergency buses; b. Load shedding from emergency buses; c. DGs of the same power train auto-start from standby condition and: <ul style="list-style-type: none"> 1. energizes permanently connected loads in ≤ 10 seconds, 2. energizes auto-connected emergency loads through load sequencer, 3. achieves steady state voltage: ≥ 6800 V and ≤ 7260 V, 4. achieves steady state frequency ≥ 59.8 Hz and ≤ 60.1 Hz, and 5. supplies permanently connected and auto-connected emergency loads for ≥ 5 minutes. 	<p>18 months</p>
<p>SR 3.8.1.20</p> <p>Verify during idle operation that any automatic or emergency start signal disables the idle start circuitry and commands the engine to full speed.</p>	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.21	Verify when started simultaneously from standby condition, each DG achieves, in ≤ 10 seconds, voltage ≥ 6800 V and frequency ≥ 58.8 Hz. Verify after DG fast start from standby conditions that the DG achieves steady state voltage ≥ 6800 V and ≤ 7260 V, and frequency ≥ 59.8 Hz and ≤ 60.1 Hz.	10 years



UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO.102 TO FACILITY OPERATING LICENSE NO. NPF-90
TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT, UNIT 1
DOCKET NO. 50-390

1.0 INTRODUCTION

By letter dated April 6, 2015 (Reference 1), Tennessee Valley Authority (TVA, the licensee) requested an amendment to Technical Specification (TS) 3.8.1 regarding diesel generator (DG) steady-state frequency for the Watts Bar Nuclear Plant (WBN), Unit 1. In order to support WBN dual-unit operation with shared equipment, the DG voltage and frequency requirements for both units must be consistent. Accordingly, the proposed amendment would revise the acceptance criteria for the DG steady-state frequency range provided in TS Surveillance Requirements (SRs) 3.8.1.2, 3.8.1.7, 3.8.1.9, 3.8.1.11, 3.8.1.12, 3.8.1.15, 3.8.1.19, and 3.8.1.21. In addition, the proposed change also affects SR 3.8.1.3, because it requires successful performance of SR 3.8.1.2 or 3.8.1.7. SR 3.8.1.3 does not directly require the DG operating frequency to be verified.

The WBN Unit 1 proposed amendment is based on an approach similar to the WBN Unit 2 submittal in response to NUREG-0847, Supplemental Safety Evaluation Report (SSER) 22, Open Item No. 32 (Reference 7).

In response to the U.S. Nuclear Regulatory Commission (NRC) staff's Request for Additional Information (RAI) in an email dated May 28, 2015 (ADAMS Accession No. ML15232A332), the licensee provided supplemental information in a letter dated July 15, 2015 (Reference 2). The additional information provided clarification to the evaluations, which were conducted to determine the effects of the DG frequency variation (59.8 to 60.1 Hertz (Hz)) on plant equipment.

The supplement dated July 15, 2015, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on May 26, 2015 (80 FR 30103).

2.0 REGULATORY EVALUATION

2.1 Proposed Changes

Currently, the acceptance criterion for the DG steady-state frequency is greater than or equal to (\geq) 58.8 Hz and less than or equal to (\leq) 61.2 Hz. The licensee proposes to change the DG steady-state frequency acceptance criteria to \geq 59.8 Hz and \leq 60.1 Hz for SRs 3.8.1.2, 3.8.1.7, 3.8.1.9, 3.8.1.11, 3.8.1.12, 3.8.1.15, 3.8.1.19, and 3.8.1.21. The current DG TS Surveillance Requirement steady-state voltage range \geq 6800 Volts (V) and \leq 7260 V is still acceptable and remains unchanged.

2.2 Regulatory Requirements

In section 4.1 of the enclosure to its application dated April 6, 2015 (Ref. 1), TVA stated that the onsite standby ac power systems at WBN Unit 1 are designed to comply with, among other things, the following:

General Design Criterion (GDC) 17, "Electric power systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, requires, in part, that nuclear power plants have an onsite and an offsite electric power system to permit the functioning of structures, systems, and components that are important to safety.

GDC 18, "Inspection and testing of electric power systems," requires, in part, that electric power systems important to safety shall be designed to permit appropriate periodic inspection and testing of important areas and features, such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the condition of their components.

The NRC staff also considered:

- (1) RG 1.9, Revision 3, "Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants," with certain exceptions, for example, WBN DG load assignment being based on RG 1.9, Position C2 of Revision 2 requiring the predicted loads not to exceed the short time rating.
- (2) NUREG-0847, "Safety Evaluation Report Related to the Operation of Watts Bar Unit 2," Docket No. 50-390, Supplement 27; and
- (3) Regulatory Guide (RG) 1.108, Revision 1, "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants."

Because TVA is proposing changes to surveillance tests, the staff compared TVA's request to the relevant part of 10 CFR 50.36 "Technical specifications." Specifically, as stated by 10 CFR 50.36(c)(3), the SRs must assure that the necessary quality of systems and components is

maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met.

3.0 TECHNICAL EVALUATION

3.1 System Description

The alternating current standby system supplies electrical power to four power trains, shared between the two units, with each train powered by an independent Class 1E 6.9 kiloVolt (kV) shutdown board. Power trains 1A and 2A comprise load group A, and power trains 1B and 2B comprise load group B. Two DGs associated with one load group can provide all safety related functions to mitigate a loss-of-coolant accident (LOCA) in one unit and achieve hot standby in the opposite unit (Reference 1).

Each DG consists of two 16-cylinder engines directly connected to a 6.9 kV generator. The continuous rating of each DG is 4400 kilowatt (kW) at 0.8 power factor, 6.9 kV, 3-phase, and 60 Hz. Each DG also has an additional rating of 4840 kW for 2 hours out of 24 hours. Ratings for the DGs satisfy the requirements of RG 1.9, Revision 3 (Reference 1).

Each 6.9 kV shutdown board has two separate and independent offsite sources of power as well as a dedicated onsite DG source. Each A and B train Emergency Safety Feature (ESF) system provides for the minimum safety functions necessary to shut down the plant and maintain it in a safe shutdown condition.

The WBN Unit 1 DG voltage and speed regulators function independent of each other. Based on this independence and stability, the licensee evaluated the composite impact of frequency and voltage for the proposed TS band.

3.2 Evaluation of Proposed Changes

Plant safety analyses evaluate flow rate requirements for motor-driven loads based on motors operating at a nominal frequency of 60 Hz. In the event of loss of offsite power (LOOP), the onsite DGs are required to support safe shutdown of the plant and mitigate the consequences of an accident.

However, the DGs may not be able to operate at exactly 60 Hz due to inherent limitations of control systems. In the License Amendment Request (LAR), the licensee has proposed a new operating range, ≥ 59.8 Hz to ≤ 60.1 Hz, for the DGs at WBN Unit 1. The DG frequency variation between 59.8 Hz to 60.1 Hz has the direct effect of changing motor speed for the motors fed from the DGs following a LOOP event or LOCA coincident with a LOOP. The changes in the motor speed affect the following attributes of motor-driven loads (References 1 and 2):

1. Pump flow rate, net positive suction head (NPSH) available and horsepower
2. Fan flow rate and horsepower
3. Motor-operated valves (MOVs) opening/closing speed and horsepower

4. Air compressor flow rate and horsepower, and
5. Chiller compressor horsepower

The nuclear steam supply system vendor, Westinghouse, performed an evaluation of the emergency core cooling system (ECCS) pump motors. Westinghouse analyzed ECCS equipment performance capabilities over the full frequency range (i.e., 59.8 Hz to 60.1 Hz) within the voltage setting range (i.e., 6925 V to 7000 V).

Westinghouse used the mathematical relationship between frequency, pump speed, flow rates, pump-head losses, and MOV operating time to develop a summary of the effects on equipment when operating at the extremes of the proposed allowable frequency range. The licensee provided a summary of the effects of frequency in the proposed range as related to the design parameters associated with major pumps in safety significant systems in Table 2 of the enclosure to the licensee's letter dated April 6, 2015 (Reference 1). The licensee also provided a summary of impact on critical ECCS equipment as related to temperature rise, flow-rates, motor horsepower, fan flow rates and MOV stroke times.

The following is a summary of TVA's proposal and the NRC staff's review:

Temperature Rise:

The licensee has stated that the change in frequency by plus or minus (\pm) 0.3 percent (%) from the rated frequency 60 Hz has minimal impact from 0.997 to 1.003 of rated motor speed.

Section 3.2.2 "Effect on Motors" of the licensee's application concluded:

A 2.0% increase or decrease in heat rise would have insignificant impact on motor life. In the case of continuously operated 480 V environmentally qualified (EQ) motors, the 40 year qualified life of the motor is based on an insulation temperature rise of 105 ° C [Centigrade]. Actual tested rise is \leq 75 ° C. Therefore, there is more than sufficient margin in the windings.

A separate evaluation was performed for large motors operating at higher voltages to determine the temperature rise and was found to be acceptable. Specifically, the auxiliary feedwater (AFW) pump motors and the emergency raw cooling water (ERCW) pump motors were evaluated for temperature rise and found acceptable (Reference 1). The licensee has concluded that motors operating at + 0.3% speed would result in approximately 2% of heat rise, which has relatively negligible impact on motor life.

The NRC staff agrees that the change in motor speed would result in minor increase in motor-operating temperature. Based on the allowable temperature rise for safety related medium voltage motors, the NRC staff concludes the above evaluation is acceptable.

Flow Rates:

The effect of change in speed of the motor from 0.997 to 1.003 of rated speed on the flow rates of major pumps, such as Residual Heat Removal (RHR), Containment Spray System (CSS), ERCW, Component Cooling Water System (CCS) –Trains A & B, and CCS 2A-A is summarized in Table 3 of the enclosure with the letter dated April 6, 2015 (Reference 1). The licensee has stated that the Westinghouse evaluation of the effect of the DG frequency range \geq 59.8 Hz and

≤ 60.2 Hz (assuming rated terminal voltage, 6600 V, or ± 3% speed change) on pump flow rate determined that the previous analyses for the following conditions remain valid or were not significantly affected:

- Large Break LOCA
- Post LOCA Long Term Core Cooling
- Small Break LOCA
- Post LOCA Subcriticality
- Steam Generator Tube Rupture
- Transient Analysis (non-LOCA events)
- Steam Line Break Mass and Energy Release
- LOCA Mass and Energy Release

The NRC staff reviewed the flow rates assumed in accident analysis. Based on the summary of the evaluation and the calculated magnitude of change in flow rates, the NRC staff concludes that the minimal impact on functional capabilities of pumps required to mitigate effects of postulated accident conditions is acceptable.

NPSH:

The NPSH evaluation for the selected critical pumps is given in Table 4 of the enclosure with the letter dated April 6, 2015 (Reference 2). An increase in frequency will result in higher pump speed, which will result in increased flows, which in turn increase suction side losses and reduces margin between available and required NPSH. A decrease in frequency will decrease the pump operating speed that will result in decreased flows which in turn decreases suction side losses and increases the margin between available and required NPSH. The licensee has evaluated that there is a 0.7% change in NPSH due to change in DG operating frequency. At the lower end of the allowable frequency of 59.8 Hz, there is a 0.7% increase in NPSH margin, which adds to the margin and does not require additional evaluation. At the upper end of the allowable frequency of 60.1 Hz, there is a 0.7% decrease in NPSH margin, which requires evaluation, and the results of the studies are summarized in Table 4 of Reference 2.

The licensee stated that Westinghouse evaluated the impact of a ± 0.3 percent speed variation (i.e., 60 ± 0.2 Hz effective) on WBN Unit 1 pump flows and determined that previous analyses remain valid or do not significantly impact previous analyses.

To support Westinghouse's evaluation, Flowserve, the ECCS pump vendor, provided input as to the expected performance of the Centrifugal Charging (CC) pumps and Intermediate Head Safety Injection (IHSI) pumps for continuous operation up to 30 days. Flowserve concluded that both pumps are expected to undergo minor cavitation damage, but would remain operational for 30 days, with gradual decline in pump/power performance.

The NRC staff submitted an RAI by email dated May 28, 2015 (ADAMS Accession ML15232A332). The licensee submitted response to the NRC staff's RAI by letter dated July 15, 2015 (Reference 2). In the RAI, the NRC staff requested information about the ECCS pump vendor (Flowserve) report on IHSI and CC pump performance and reference documents for the basis of calculations.

The licensee provided Flowserve report (ADAMS Accession No. ML15222A430) and calculation MDQ00299920110380, Revision 008 ("Evaluation of the Impact of Diesel Generator (DG) Frequency and Voltage Limits"). The analyses in the calculation and Flowserve report are consistent with the information provided in the April 6, 2015 LAR, (Reference 1).

The summary of changes in NPSH for selected critical pumps indicates that operation of the DG in a frequency range ≥ 59.8 Hz and ≤ 60.2 Hz would have no significant effect on pump NPSH margin.

NRC staff reviewed the Flowserve report for CC and IHSI pumps and concluded that minor cavitation resulting from change in NPSH is acceptable as these pumps are required to operate for less than 10 days for postulated accident conditions. Based on data provided by the licensee, the NRC staff finds it acceptable that the minor decrease in NPSH margin for the pumps listed in Table 4 of Reference 2 will not have any significant adverse effects on accident mitigating equipment because the allowed NPSH for each pump is greater than the required NPSH.

Brake Horsepower:

The licensee has concluded that the brake horsepower (BHP) of motors due to a speed variation of $\pm 0.3\%$ will vary by 1.0%. Table 5 (Reference 1) provides a summary of the major pump BHP as a result of frequency variation of $\pm 0.3\%$. The licensee has concluded that the change in BHP of RHR, IHSI, and CCS pump motors is acceptable as these motors have a service factor of 1.15. The amount of continuous horsepower a motor can deliver is calculated by multiplying the service factor with the rated nameplate horsepower. The CC pump motors do not exceed the nameplate rating and, therefore, are acceptable. A slightly higher/lower horsepower ($\pm 0.3\%$) increase does not impact pump performance of CC pump motors. The AFW pump motors and the ERCW pump motors were evaluated for temperature rise and found acceptable (Reference 1). A small increase in horsepower requirement ($\pm 1.0\%$) and thus the slightly higher or lower flow rates has no impact on the safe operation of Fuel Oil Transfer Pump. Based on the information provided by the licensee, the change in BHP of major ECCS motors due to allowable frequency variations will not impact motor capability or adversely impact motor performance.

The NRC staff reviewed the summary of the evaluation results and available margin in motor sizes and concluded that the licensee's analysis is acceptable. The motors will continue to operate within the nameplate capability and the minor change in flow rates for pumps such as fuel oil transfer pump will not affect plant safe shutdown capability.

Fans and Air Handling Units (AHUs):

In section 3.2.7 of the enclosure to the letter dated April 6, 2015 (Reference 1) the licensee provided a list of fans and AHUs that were evaluated for impact due to variations in DG frequency. The fan flow is directly proportional to fan speed. The licensee has established an acceptance criteria for fan flow rates required during accident mitigation. The licensee has stated "Flow rate tolerances for fans and AHUs require total system airflow at the system fan and/or inlet to be not less than 90% of fan design rated flow for existing systems and 95% of fan design rated flow for new systems for other than air-cleaning units. In addition, the maximum system flow shall not exceed 110% of the system's fan rated flow." In Table 2 (Reference 1) the

licensee identified that the flow rates will change by 0.3% within the allowable frequency range. Therefore, the change in flow rates for frequency range ≥ 59.8 Hz and ≤ 60.1 Hz is well within the acceptance criteria.

The NRC staff concludes that the change in flow rates for fans and AHUs is within the acceptance criteria and therefore are acceptable.

Motor-Operated Valves:

Based on the MOV evaluation, the licensee has concluded that MOV stroke time will be less than 0.8% longer as a result of the slower motor speed due to the change in the frequency. The licensee has stated that stroke time is not a concern because sufficient margin exists between the calculated stroke times and stroke times used in the safety analysis. In addition, the licensee stated that the minimum allowable DG voltage provides a voltage that is greater than the voltage used for the GL 89-10 (Reference 9) analysis.

The NRC staff concluded that MOV performance in the proposed DG operating range is acceptable because the minor change in stroke time will not adversely impact the flow rates assumed in the safety analyses and therefore, the proposed changes have no adverse impact on MOV stroke times.

The licensee also evaluated the impact of frequency variation on equipment such as an air compressor and chiller flows, power transformers, battery chargers and hydrogen igniters. A $\pm 0.3\%$ change in load times for intermittently operated equipment has negligible impact on compressors and chillers. There is no detrimental effect on power transformers. In the case of battery chargers, the proposed DG frequency range of ≥ 59.8 and ≤ 60.1 Hz is bounded by the operational tolerance of the battery chargers ($\pm 5\%$ of the rated frequency 60 Hz). Therefore, this variation is considered to be negligible and there is no effect on the operation of the 125 V dc vital battery chargers. The effect on hydrogen igniters is that their operating temperature may be affected by changes in voltage and/or frequency, and subsequently their ability to control hydrogen following a LOCA. The hydrogen igniters are supplied by a regulated transformer which maintains a $\pm 1\%$ regulation for a voltage range of $\pm 10\%$ and frequency range of $\pm 5\%$. Therefore, there is no impact to the hydrogen igniters due to minor voltage and/or frequency variations.

The NRC staff concluded that the licensee evaluation is acceptable and the equipment will perform within the design requirements.

Effect on DG Loading:

For frequencies above 60 Hz, the increase in motor speed is directly proportional. However, horsepower requirements for a motor is increase by the cube of the speed and the resultant change in horsepower will impose additional load on the DGs. The licensee conservatively assumed that all loads are impacted by the higher DG frequency and used a factor of 1.010 to evaluate the change in DG loading and concluded that the loading is still under the DG rating. The licensee also evaluated cumulative impact of the DG upper voltage limit of 7260 V and frequency of 60.2 Hz for DG loading under the LOOP/LOCA scenario for DG 1A-A, which is the heaviest loaded DG. The results indicate that there is a 6.4% margin available compared to the nominal DG rating of 4400 kW. The licensee has concluded that the DG will not be overloaded

during design-basis accident conditions and the design will remain in compliance with RG 1.9 guidance.

The NRC staff reviewed the change in DG loading provided by the licensee in the LAR and found it acceptable.

The DG fuel oil consumption calculation is based on the nominal rating of the DG. Since the DG loading during extended operation is not expected to exceed the nominal rating, the licensee has stated the fuel oil consumption requirements are not impacted.

The NRC staff finds that the impact of the fuel consumption variation is negligible and within the acceptance criteria.

In the RAI, the NRC staff requested an explanation of the inconsistency of NPSH parameters between the statement in section 3.2.4 and the information in Table 4 of the April 6, 2015, submittal; see TVA's RAI response dated July 15, 2015 (Reference 2). In response, the licensee revised Table 4 (Reference 2) and also revised the calculation, "Evaluation of the Impact of Diesel Generator (DG) Frequency and Voltage Limits," (Reference 11). The revisions corrected the inconsistencies noted and do not impact the original analysis provided with the LAR. Therefore the staff finds the response acceptable.

In the RAI, the NRC staff also questioned the reason for the minor differences in the BHP for all the pump motors except the CS pumps and the difference in the BHP for the CC pumps between the two units. The licensee responded that motors were procured at nameplate rating, which is close to or above the operating load and hence the discrepancy. In the case of CC pumps the information for both units came from the calculation "Evaluation of the Impact of Diesel Generator (DG) Frequency and Voltage Limits, (Reference 11). Revision 002 of this calculation provided BHP at 60.1 Hz, which was used in Table 5 of Enclosure 1 of the licensee's response to information requests identified during the WBN Unit 2 license review (Reference 7). In revision 003, the calculation was based on 60.2 Hz instead of 60.1 Hz, which was used in the WBN Unit 2 submittal. In the RAI response dated July 15, 2015 (Reference 2), TVA initiated the Condition Report 1041928 for WBN 2 in accordance with the TVA Corrective Action Program to document the error in the information submitted for the WBN Unit 2 license review. The NRC staff finds the licensee's response acceptable because it adequately addresses the staff's RAIs regarding inconsistencies in the April 6, 2015, LAR for WBN Unit 1 and docketed information regarding WBN Unit 2 license review.

3.3 Technical Conclusion

The NRC staff has reviewed the licensee's analysis provided in letter dated April 6, 2015 (Reference 1), and the licensee's RAI response provided in the letter dated July 15, 2015 (Reference 2). The NRC staff concludes that the licensee has adequately evaluated the change in equipment performance due to the proposed change in the allowable operating frequency range for the onsite DGs.

The proposed amendment would revise the DG frequency range which is more conservative than the existing frequency range and therefore, there is no impact on onsite power systems.

Therefore, the NRC staff finds that the proposed amendment meets the requirements of GDC 17.

The proposed amendment would revise the acceptance criteria for the DG steady-state frequency range provided in TS Surveillance Requirements (SRs) 3.8.1.2, 3.8.1.7, 3.8.1.9, 3.8.1.11, 3.8.1.12, 3.8.1.15, 3.8.1.19, and 3.8.1.21 and there is no change in the methodology of testing and inspection. Therefore, the proposed amendment would not impact the inspection and testing of electric power systems important to safety. The NRC staff finds that the proposed amendment will continue to satisfy the requirements of GDC 18.

Based on the above evaluation, the NRC staff finds the proposed changes to the WBN Unit 1 TSs provides reasonable assurance of the continued availability of the required electrical power to shut down the reactor and to maintain the reactor in a safe condition after an anticipated operational occurrence or a postulated design-basis accident. Based on this determination the staff concluded that there is reasonable assurance that the requirements of 10 CFR 50.36 will continue to be met. Furthermore, the NRC staff concludes that the proposed TS changes are in accordance with 10 CFR 50, Appendix A, GDC 17 and 18. WBN Unit 1 is consistent with RG 1.9 Revision 2 and 3 as clarified in Section 4.1 of Reference 1. Therefore, the staff finds the proposed changes acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Tennessee State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes surveillance requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding; see the FR notice published on May 26, 2015 (80 FR 30103). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

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

7.0 REFERENCES:

1. Enclosure in TVA letter to NRC (CNL-14-218), "Application to Modify Watts Bar Nuclear Plant, Unit 1 Technical Specification 3.8.1 Regarding Diesel Generator Steady-State Frequency (WBN-TS-13-08)," dated April 6, 2015 (ADAMS Accession No. ML15117A462).
2. Enclosure in TVA letter to NRC (CNL-15-133), "Response to Request for Additional Information Related to Unit 1 Technical Specification 3.8.1 Regarding Diesel Generator Steady-State Frequency (WBN-TS-13-08)," dated July 15, 2015 (ADAMS Accession No. ML15197A145).
3. Regulatory Guide 1.9, Revision 3, "Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electrical Power Systems at Nuclear Power Plants."
4. Regulatory Guide 1.9, Revision 2, "Selection, Design, and Qualification of Diesel Generator Units Used as Standby (Onsite) Electrical Power Systems at Nuclear Power Plants."
5. WBN Updated Final Safety Analysis Report Section 8.3, "Onsite (Standby) Power System."
6. The Institute of Electrical and Electronics Engineers Standard 308-1971, "Criteria for Class 1E Power Systems for Nuclear Power Generating Stations."
7. TVA, Letter to the NRC, "Watts Bar Nuclear Plant (WBN) Unit 2 - Diesel Generator Frequency - Response to NUREG 0847 SSER 22, Open item 32," dated February 3, 2014 (ADAMS Accession No. ML14038A079).
8. NUREG-0847, "Supplemental Safety Evaluation Report 27," dated January 2015, Appendix HH, Watts Bar Unit 2 Action Items Table (ADAMS Accession No. ML15033A041).
9. Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," dated June 28, 1989 and "Supplement 1 to Generic Letter 89-10: Results of the Public Workshops," dated June 13, 1990.
10. TVA letter dated August 7, 2015, Response to Request for Flowserve Technical Report on Run-out Flow Operation for a Diesel Generator Frequency above 60 Hertz and Flowserve Report GS-8236, Revision 3, "Run-Out Flow Operation Capability Analysis," dated April 3, 2013 (ADAMS Accession No. ML15222A430).

11. Calculation MDQ00299920110380, "Evaluation of the Impact of Diesel Generator (DG) Frequency and Voltage Limits," Revision 008.

Contributor: H. Kodali

Dated: September 17, 2015

September 17, 2015

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3R-C
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 - ISSUANCE OF AMENDMENT
REGARDING MODIFICATION TO TECHNICAL SPECIFICATION 3.8.1
REGARDING DIESEL GENERATOR STEADY STATE FREQUENCY
(TAC NO. MF6153)

Dear Mr. Shea:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 102 to Facility Operating License No. NPF-90 for the Watts Bar Nuclear Plant, Unit 1. This amendment consists of a change to Technical Specification (TS) 3.8.1 regarding the diesel generator (DG) steady-state frequency in response to your application dated April 6, 2015, as supplemented by letter dated July 15, 2015. The amendment would revise the acceptance criteria for the DG steady-state frequency range provided in several TS Surveillance Requirements.

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice. If you have any questions regarding this letter, please contact me at (301) 415-1349.

Sincerely,
/RA/

Jeanne A. Dion, Project Manager
Watts Bar Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosures:

- 1. Amendment No. 102 to NPF-90
- 2. Safety Evaluation

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ADAMS Accession No.: ML15230A155

*by memo dated 7/31/15 8*by email

OFFICE	NRR/DORL/LPWB/PM	NRR/DORL/LPWB/LA	NRR/DE/EEEB*	NRR/DSS/STSB
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DATE	08/26/15	08/26/15	07/31/15	09/15/15
OFFICE	NRR/DE/EPNB*	OGC - NLO	NRR/DORL/LPWB/BC	NRR/DORL/LPWB/PM
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DATE	08/31/15	09/14/15	09/17/15	09/17/15

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