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

March 28, 2018

Mr. Joseph W. Shea
Vice President, Nuclear Regulatory Affairs
and Support Services
Tennessee Valley Authority
1101 Market Street, LP 4A
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 - ISSUANCE OF AMENDMENT REGARDING REACTOR PROTECTION SYSTEM INSTRUMENTATION TURBINE TRIP FUNCTION (CAC NO. MF9401; EPID L-2017-LLA-0189)

Dear Mr. Shea:

The U.S. Nuclear Regulatory Commission (Commission) has issued the enclosed Amendment No. 119 to Facility Operating License No. NPF-90 for the Watts Bar Nuclear Plant, Unit 1. This amendment is in response to your application dated March 16, 2017, as supplemented by your letter dated August 31, 2017.

This amendment revises Technical Specification Table 3.3.1-1, "Reactor Trip System Instrumentation," to reflect plant modifications to the reactor protection system instrumentation associated with the turbine trip on low fluid oil pressure.

A copy of the safety evaluation is also enclosed. Notice of issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

Robert G. Schaaf, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosures:
1. Amendment No. 119 to NPF-90
2. Safety Evaluation

cc: Listserv

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. 119
License No. NPF-90

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Tennessee Valley Authority (TVA, the licensee) dated March 16, 2017, as supplemented August 31, 2017, 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 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.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and 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. 119 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 no later than startup from the Unit 1 refueling outage scheduled for fall 2018.

FOR THE NUCLEAR REGULATORY COMMISSION

Brian W. Tindell

Brian W. Tindell, Acting Chief
Plant Licensing Branch II-2
Division of operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Operating License
and Technical Specifications

Date of Issuance: March 28, 2018

ATTACHMENT TO AMENDMENT NO. 119

WATTS BAR NUCLEAR PLANT, UNIT 1

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 page of the Appendix A Technical Specifications with the attached page. The revised page is identified by amendment number and contains vertical lines indicating the areas of change.

Remove Page	Insert Page
3.3-18	3.3-18

(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. 119 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.

Table 3.3.1-1 (page 4 of 9)
Reactor Trip System Instrumentation

	FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
13.	SG Water Level -- Low-low Coincident with:	1, 2	3/SG	U	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.15	≥ 16.4% of narrow range span	17% of narrow range span
	a) Vessel ΔT Equivalent to power ≤ 50% RTP	1, 2	3	V	SR 3.3.1.7 SR 3.3.1.10	Vessel ΔT variable input ≤ 52.6% RTP	Vessel ΔT variable input 50% RTP
	With a time delay (Ts) if one steam generator is affected					≤ 1.01 Ts (Refer to Note 3, Page 3.3-23)	Ts (Refer to Note 3, Page 3.3-23)
	or						
	A time delay (Tm) if two or more steam generators are affected					≤ 1.01 Tm (Refer to Note 3, Page 3.3-23)	Tm (Refer to Note 3, Page 3.3-23)
	OR						
	b) Vessel ΔT Equivalent to power > 50% RTP with no time delay (Ts and Tm = 0)	1, 2	3	V	SR 3.3.1.7 SR 3.3.1.10	Vessel ΔT variable input ≤ 52.6% RTP	Vessel ΔT variable input 50% RTP
14.	Turbine Trip						
	a. Low Fluid Oil pressure	1[i]	3	O	SR 3.3.1.10[g][h] SR 3.3.1.14	≥ 710 psig	800 psig
	b. Turbine Stop Valve Closure	1[i]	4	Y	SR 3.3.1.10 SR 3.3.1.14	≥ 1% open	1% open

(continued)

(g) If the as found channel setpoint is outside its predefined as found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(h) The instrument channel setpoint shall be reset to a value that is within the as left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. The methodologies used to determine the as found and as left tolerances for the NTSP are specified in FSAR Section 7.1.2.

(i) Above the P-9 (Power Range Neutron Flux) interlock.

UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 119 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 March 16, 2017 (Reference 1), as supplemented by letter dated August 31, 2017 (Reference 2), Tennessee Valley Authority (TVA), the licensee, submitted a request for changes to the Technical Specifications (TSs) for Watts Bar Nuclear Plant (Watts Bar or WBN), Unit 1. The requested changes would revise TS limiting condition for operation (LCO) 3.3.1, "Reactor Trip System (RTS) Instrumentation," Table 3.3.1-1, to reflect plant modifications to the reactor protection system (RPS) Instrumentation associated with the turbine trip on low fluid oil pressure. The proposed change is due to the replacement and relocation of the pressure switches from the low pressure auto-stop trip (AST) fluid oil header that operates at a nominal control pressure of 80 pounds per square inch gauge (psig) to the high pressure turbine electrohydraulic control (EHC) oil header that operates at a nominal control pressure of 2000 psig. The changes to the nominal trip setpoint (NTSP) and allowable value (AV) are needed due to the higher EHC system operating pressure.

In addition, the proposed amendment requests changes in accordance with Technical Specification Task Force (TSTF) Change Traveler TSTF-493, Revision 4, "Clarify Application of Setpoint Methodology for LSSS [Limiting Safety System Setting] Functions," Option A, (Reference 3), for the turbine trip low fluid oil pressure function.

The supplement dated August 31, 2017, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on June 6, 2017 (82 FR 26140).

2.0 REGULATORY EVALUATION

2.1 System Description

The reactor trip system (RTS) initiates a unit shutdown based on the values of selected unit parameters to protect against violating the core fuel design limits and reactor coolant system (RCS) pressure boundary during anticipated operational occurrences and to assist the engineered safety features systems in mitigating accidents.

The protection and monitoring systems have been designed to assure safe operation of the reactor. This is achieved by specifying LSSSs in terms of parameters directly monitored by the RTS, as well as specifying LCOs on other reactor system parameters and equipment performance.

The turbine trip low fluid oil pressure trip function anticipates the loss of heat removal capabilities of the secondary system following a turbine trip. This trip function acts to minimize the pressure/temperature transient on the reactor. The reactor trip on a turbine trip is actuated by two-out-of-three logic from low oil pressure signals (TS Table 3.3.1-1 Item 14.a Low Fluid Oil Pressure) or by closed signals from all four turbine steam stop valves (TS Table 3.3.1-1 Item 14.b Turbine Stop Valve Closure). The circuitry associated with the pressure switches is independent of the turbine control system and does not perform any turbine control functions.

A turbine trip causes a direct reactor trip above the P-9 setpoint of approximately 50 percent (%) power. Any turbine trip from a power level below the P-9 setpoint will not directly trip the reactor, but will allow the reactor control system to bring the reactor to zero power utilizing steam dump to the condenser as an artificial load. The reactor trip on turbine trip provides additional protection and conservatism beyond that required for the health and safety of the public. No credit is taken in the accident analyses for this trip.

2.1.2 Existing Pressure Switch Configuration

Three pressure switches are located on the low pressure fluid oil header (also referred to as the AST system). The three low oil pressure switches have two output contacts that provide redundant inputs to each of the three RPS protection channels I, II, and III (two-out-of-three logic). This signal initiates a reactor trip on a turbine trip if reactor power is above the P-9 power range neutron flux interlock (approximately 50% of full power). The low pressure AST fluid oil header operates at a nominal control pressure of approximately 80 psig. The existing NTSP is 45 psig and the AV is greater than or equal to (≥) 43 psig.

2.1.3 Proposed Pressure Switch Configuration

The licensee stated in its license amendment request (LAR) that the proposed modifications to the EHC system will remove the AST oil header where the existing low oil pressure switches are located. To support this modification, the RPS trip function will be performed by three new pressure switches located on the high pressure turbine EHC trip header. As with the original pressure switches, the three new pressure switches have two output contacts that provide redundant inputs to each of the three RPS protection channels I, II, and III (two-out-of-three logic). The RPS logic will not be affected by the change and the signal will still initiate a reactor trip on a turbine trip if reactor power is above the P-9 power range neutron flux interlock.

The EHC system supplies hydraulic control oil fluid to the turbine stop, governor, intercept and reheat valves. The EHC fluid is provided by skid-mounted hydraulic pumps that maintain operating pressure at approximately 2000 psig. The changes to the NTSP and AV are needed due to the higher EHC system operating pressure. The operation of the turbine is dependent on maintaining proper EHC system pressure. On a turbine trip initiation signal, EHC dump valves connected to the EHC fluid header are signaled to open draining the EHC fluid from the piping. The EHC header pressure is rapidly decreased, closing the turbine stop valves and tripping the turbine.

The decreased EHC fluid pressure will be sensed by the new low fluid oil pressure switches. When the decreased pressure is sensed by the pressure switches, a reactor trip signal will be initiated by two-out-of-three RPS channels. The circuitry associated with the pressure switches and the RPS is independent of the new turbine control system.

The licensee stated in the LAR that, because the reactor trip on turbine trip function of the low fluid oil pressure is not credited in the accident analysis, the pressure switches are quality related, non-seismic devices. (Section 7.2.2.2 of the Watts Bar Updated Final Safety Analysis Report (USFAR) references UFSAR Chapter 17 for a discussion of component quality, which in turn references the TVA Nuclear Quality Assurance Plan, TVA-NQA-PLN89A (Reference QA). "Quality related" is defined in Appendix C of the latest revision of the plan.) The licensee stated that the switches are similar to switches used in similar EHC applications at the Browns Ferry Nuclear Plant (Browns Ferry) on the turbine stop valves. The new switches are designed for consistent, dependable operation at the higher EHC fluid oil pressure. Operational experience at Browns Ferry has shown this style of switch to be reliable.

The licensee also stated in the LAR that it has evaluated and confirmed, as described in Section 3.2.1 of the LAR, that the proposed AV of 710 psig is sufficient to account for uncertainties for the pressure switches being used, in accordance with TVA Branch Technical Instruction BTI-EEB-TI-28, "Setpoint Calculations."

The licensee stated that BTI-EEB-TI-28 incorporates methodologies for the determination of setpoints for nuclear safety-related instrumentation in Instrument Society of America (ISA) Standard ISA-S67.04-1982 and 1994, "Setpoints for Nuclear Safety-Related Instrumentation Used in Nuclear Power Plants," as endorsed in Regulatory Guide (RG) 1.105, Revisions 2 and 3, respectively. Although the pressure switches are considered non-safety related, the new turbine trip setpoint on low fluid oil pressure has been determined in accordance with BTI-EEB-TI-28. Instrument uncertainties such as calibration error and drift were considered in determining a total device uncertainty for the pressure switches.

2.2 TS Proposed Changes

The licensee proposed to replace and relocate the pressure switches from the low pressure AST fluid oil header that operates at a nominal control pressure of 80 psig to the high pressure turbine EHC oil header that operates at a nominal control pressure of 2000 psig. The changes to the NTSP and AV are needed due to the higher EHC system operating pressure. The licensee stated in its LAR that relocation of the initiating pressure switches to the high pressure turbine EHC header is needed to accommodate a modification to the EHC turbine control system while maintaining the function of transmitting the trip signal to the RPS. This change does not affect any RPS trip functions.

The licensee proposed the following changes to the AV, NTSP and footnotes of TS Table 3.3.1-1 as follows:

The existing TS states (in part):

FUNCTION	ALLOWABLE VALUE	SURVEILLANCE REQUIREMENTS	NOMINAL TRIP SETPOINT
14. Turbine Trip a. Low Fluid Oil Pressure	≥ 43 psig	SR 3.3.1.10 SR 3.3.1.14	45 psig

The proposed TS would state (in part):

FUNCTION	ALLOWABLE VALUE	SURVEILLANCE REQUIREMENTS	NOMINAL TRIP SETPOINT
14. Turbine Trip a. Low Fluid Oil Pressure	≥ 710 psig	SR 3.3.1.10[(g)(h)] SR 3.3.1.14	800 psig

As shown above, the AV would be changed from ≥ 43 psig to ≥ 710 psig, and the NTSP would be changed from 45 psig to 800 psig. The licensee also proposed the addition of surveillance footnotes (g) and (h), consistent with Option A of TSTF-493, Revision 4, to address instrumentation LCO issues that could occur during periodic testing and calibration of instrumentation. The proposed footnotes are related to channel calibration and would apply to surveillance requirement (SR) 3.3.1.10, only for Function 14.a:

> (g) If the as found channel setpoint is outside its predefined as found tolerance [AFT], then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.
>
> (h) The instrument channel setpoint shall be reset to a value that is within the as left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. The methodologies used to determine the as found and as left tolerances for the NTSP are specified in FSAR Section 7.1.2.

These surveillance footnotes would require the licensee to assess channel performance during testing that verifies instrument channel setting values established by TVA's setpoint methodology. The licensee stated in its LAR that, although minor variations were proposed, TSTF-493 and the associated U.S. Nuclear Regulatory Commission (NRC) staff's safety evaluation (SE) (Reference 4) are applicable to Watts Bar, Unit 1.

2.3 Regulatory Requirements

The Watts Bar dual-unit UFSAR, Section 3.1.1, states, in part:

> The Watts Bar Nuclear Plant was designed to meet the intent of the "Proposed General Design Criteria for Nuclear Power Plant Construction Permits" published in July 1967. The Watts Bar construction permit was issued in January 1973. This UFSAR, however, addresses the NRC General Design Criteria (GDC)

published as Appendix A to [Title 10 *Code of Federal Regulations*] 10 CFR [Part 50] in July 1971, including Criterion 4 as amended October 27, 1987.

The Watts Bar UFSAR provides a discussion of the design features and procedures which meet the intent of the design criteria, including a discussion of any exceptions to the GDC. The GDC that are relevant to this LAR are listed in the UFSAR as follows:

Criterion 13 - Instrumentation and Control

Instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. Appropriate controls shall be provided to maintain these variables and systems within prescribed operating ranges.

Criterion 20 - Protection System Functions

The protection system shall be designed (1) to initiate automatically the operation of appropriate systems including the reactivity control systems, to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences and (2) to sense accident conditions and to initiate the operation of systems and components important to safety.

Criterion 22 - Protection System Independence

The protection system shall be designed to assure that the effects of natural phenomena, and of normal operating, maintenance, testing, and postulated accident conditions on redundant channels do not result in loss of the protection function, or shall be demonstrated to be acceptable on some other defined basis. Design techniques, such as functional diversity or diversity in component design and principles of operation, shall be used to the extent practical to prevent loss of the protection function.

Criterion 23 - Protection System Failure Modes

The protection system shall be designed to fail into a safe state or into a state demonstrated to be acceptable on some other defined basis if conditions such as disconnection of the system, loss of energy (e.g., electric power, instrument air), or postulated adverse environments (e.g., extreme heat or cold, fire, pressure, steam, water, and radiation) are experienced.

The Commission's regulatory requirements related to the content of the TSs are contained in 10 CFR 50.36. Section 50.36(b) requires that each nuclear power plant operating license include TSs. The regulation requires, in part, that the TSs include items in the following categories: (1) safety limits, limiting safety systems settings, and limiting control settings; (2) LCOs; (3) SRs; (4) design features; and (5) administrative controls. However, the regulation does not specify the particular requirements to be included in TSs.

Section 50.36(c)(1)(ii)(A) states, in part:

> Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded. If, during operation, it is determined that the automatic safety system does not function as required, the licensee shall take appropriate action, which may include shutting down the reactor.

Section 50.36(c)(3) states:

> Surveillance requirements are requirements relating to test, calibration, or inspection to 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.

2.4 Regulatory Guidance

RG 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation," describes a method acceptable to the NRC staff for complying with the NRC regulations for assuring that setpoints for safety-related instrumentation are initially within and remain within the TS limits (Reference 6). The RG endorses Part 1 of ISA-S67.04-1994, "Setpoints for Nuclear Safety-Related Instrumentation," subject to NRC staff clarifications. The ISA standard provides a basis for establishing setpoints for nuclear instrumentation for safety systems and addresses known contributing errors in the channel: Part 1 establishes a framework for ensuring that setpoints for nuclear safety-related instrumentation are established and maintained within specified limits.

NUREG-0800 (Standard Review Plan) Branch Technical Position 7-12 describes the information to be submitted for review of a licensee's instrument setpoints, including:

- A description of the setpoint methodology and procedures used in determining setpoints, including information sources, scope, assumptions, interface reviews, and statistical methods.
- The basis for acceptable as-found band and acceptable as-left band and determination of the instrument operability based on the acceptable as-found band and acceptable as-left band.
- The basis for assumptions regarding instrument uncertainties and a discussion of the method used to determine uncertainty values.

Regulatory Issue Summary (RIS) 2006-17, "NRC Staff Position on the Requirements of 10 CFR 50.36, Technical Specifications, Regarding Limiting Safety System Setting During Periodic Testing and Calibration of Instrument Channels," addresses limiting safety system settings during periodic testing and calibration of instrument channels (Reference 7). This RIS discusses issues that could occur during testing of LSSSs and which, therefore, may have an adverse effect on equipment operability. This RIS also presents an approach, found acceptable to the NRC staff, for addressing these issues for use in licensing actions that require prior NRC staff approval.

The NRC staff also considered guidance in NUREG-1431, Revision 4, "Standard Technical Specifications, Westinghouse Plants" (Reference 8).

3.0 TECHNICAL EVALUATION

3.1 Evaluation of the Proposed New Pressure Switch Configuration

On a turbine trip initiation signal, EHC dump valves connected to the EHC fluid header are signaled to open, draining the EHC fluid from the piping. The EHC header pressure decreases rapidly, thereby closing the turbine stop valves and tripping the turbine. The decreased EHC fluid pressure is sensed by the new low fluid oil pressure switches. When the decreased pressure is sensed by the pressure switches, a reactor trip signal is initiated by two out of the three RPS channels if reactor pressure is above the P-9 power range neutron flux interlock (approximately 50% of full power). The circuitry associated with the pressure switches and the RPS is independent of the new turbine control system.

The licensee stated that the proposed configuration will allow the RPS trip function to be performed by three new pressure switches in a different location but with the same function. The new pressure switches are located on the high pressure turbine EHC trip header. Consistent with the original pressure switches, the three new pressure switches have two output contacts that provide redundant inputs to each of the three RPS protection channels I, II, and III (two-out-of-three logic). The RPS logic is not affected by the change and the signal will still initiate a reactor trip on a turbine trip if reactor power is above the P-9 power range neutron flux interlock (approximately 50% of full power).

The licensee stated that it has evaluated and confirmed that the AV of 710 psig is sufficient to account for uncertainties for the pressure switches being used at Watts Bar in accordance with TVA BTI-EEB-TI-28, "Setpoint Calculations." The setpoint is offset from the AV, including uncertainties, such that the limit will not be exceeded due to instrument uncertainties expected to be present between calibrations. The licensee stated in Reference 2 that there is no discernable difference in the time interval from depressurization to trip logic initiation between the current auto-stop oil system configuration and the proposed high pressure turbine EHC oil system configuration.

The UFSAR does not contain any response time requirements for the initiation of this trip. The response times for the reactor trip on a turbine trip function from the low oil pressure switches are not included in the scope of plant surveillance instructions that verify safety system initiation and trip response times.

TVA surveillance instructions that apply to a different part of the plant solid-state protection system (SSPS) circuity (i.e., not associated with the low oil pressure switch function), test the time to depressurize the auto-stop oil system line and the resulting closure of the turbine stop valves. These surveillance instructions require that the desired response time to fully close the stop valves is less than or equal to (≤) 0.75 seconds, which includes the time to depressurize the EHC lines.

The licensee stated that with the existing EHC configuration, the auto-stop oil system line is depressurized by the actuation of protective devices, solenoid trip valves or an emergency trip valve on a turbine trip condition. The EHC fluid is an incompressible fluid. Therefore, when the solenoid and emergency trip valves are opened, the dump valves at each main steam governor and stop valve are depressurized and the high-pressure EHC fluid to the main steam governor

and stop valve actuators is released to drain (approximately zero psig). The governor and stop valves are spring actuated closed so that when the high-pressure EHC fluid is removed from the valve actuators, they close. In testing instructions, a protective relay (K621) is manually actuated that energizes to open the auto-stop oil line solenoid and emergency trip valves and depressurizes the auto-stop oil line. The time interval from the actuation of relay K621 to the closure of the stop valves is recorded and verified to be ≤ 0.75 seconds. Because this action includes the time to close the stop valves, the time to depressurize the auto-stop oil line is also ≤ 0.75 seconds.

The licensee stated that with the new EHC configuration, a solenoid valve trip block assembly is connected to the high-pressure EHC emergency trip header. On a trip condition, the solenoid valves are de-energized and open to depressurize the dump valves that release the high-pressure EHC fluid to the main steam governor and stop valves actuators to drain (approximately zero psig). By removal of the low-pressure auto-stop line, the time to directly depressurize the high-pressure EHC emergency trip header is expected to be the same or better than the existing configuration. The time response of the new trip block assembly to depressurize the EHC lines and close the stop valves is confirmed during post installation testing by the performance of plant surveillance instructions. With the modified EHC system, protective relay K621 is manually actuated which energizes interposing control relays that open normally closed contacts to de-energize the new EHC solenoid trip block assembly, which depressurizes the high-pressure EHC Emergency Trip header. The time interval from the actuation of relay K621 to the closure of the stop valves will be recorded and verified to be ≤ 0.75 seconds. Therefore, the time to depressurize the EHC header to less than the low oil pressure switch actuation setpoint is ≤ 0.75 seconds for both the existing and new configuration.

The NRC staff reviewed the information provided by the licensee and finds it to be acceptable because the time interval between depressurization to trip logic initiation for the existing and the proposed trip systems is essentially the same and there are no negative effects.

The licensee stated in Reference 2 that the new pressure switch has a hydraulically actuated piston that closes the electrical contacts on the switch. The only electrical connections to the pressure switch are to the two sets of contacts on the switches. The wiring to the existing pressure switches will be lifted and re-landed on the new pressure switches so that the electrical connections to the SSPS are the same as the existing pressure switches. Power to one set of the contacts on each pressure switch is from SSPS Train A. Power to the second set of contacts on each pressure switch is from SSPS Train B. The SSPS system is configured as a fail-safe system so that a scram is initiated on a loss of SSPS power to one train of the SSPS system.

The NRC staff reviewed the information provided by the licensee and finds it to be acceptable because there are no changes in the electrical power design for this proposed change.

WBN UFSAR 7.2.1.1.2, "Reactor Trips," subsection 6, "Reactor Trip on a Turbine Trip," states, in part:

> The reactor trip on turbine trip provides additional protection and conservatism beyond that required for the health and safety of the public. This trip is included as part of good engineering practice and prudent design. No credit is taken in any of the accident analyses (Chapter 15) for this trip.

Channel separation is maintained from the sensors to the reactor protection system logic input cabinets for both the low auto-stop oil pressure signals and the steam stop valves closed signals. This design meets the redundancy and separation requirements identical to those for Class 1E circuits. Mounting and location is in non-seismic Category I structures. The turbine provides anticipatory trips to the reactor protection system from contacts that change position when the turbine stop valves close or when the turbine auto-stop oil pressure goes below its setpoint.

The licensee stated in the LAR that the proposed NTSP, 800 psig, for turbine trip on low fluid oil pressure is consistent with the EHC operating system pressure range associated with this parameter for WBN Unit 1. The selection of this value is consistent with NUREG-1431 (Standard Technical Specification Table 3.3.1-1, Function 16.a) and was based on the minimum required EHC fluid oil pressure, the expected calibration tolerance and frequency of the switches, and the expected time-based drift of the pressure switches.

The associated AV, 710 psig, was proposed in accordance with the licensee's setpoint methodology, BTI-EEB-TI-28. The licensee provided in Reference 2 the basis and sample calculations for the acceptance band (or as-left tolerance), the normal measurable accuracy (or AFT), and the AV associated with the proposed NTSP of 800 psig. The licensee stated that performance data was used to evaluate the AV instead of total loop uncertainty because there is no associated analytical limit for this trip. The licensee's evaluation determined that the as-left tolerance, although calculated at a higher value, would be conservatively set to equal the reference accuracy, or 48 pounds per square inch (psi). The AFT was determined using historical drift data for similar pressure switches and EHC application. The largest bias was the negative AFT calculated at 90.43 psi. The AV was calculated using AFT, the most limiting value, and rounded up to 710 psi. The NRC staff reviewed the licensee's setpoint calculations for the proposed changes and finds them acceptable because they are conservative and the approved setpoint methodology was followed.

The new EHC pressure switches monitor the control oil pressure in the Turbine Electrohydraulic Control System high pressure header. A low pressure condition sensed by two-out-of-three pressure switches will actuate a reactor trip if in Mode 1 and above P-9 permissive. These pressure switches do not provide any input to the control system. The unit is designed to withstand a complete loss of load and not sustain core damage or challenge the RCS pressure limitations. Core protection is provided by the Pressurizer Pressure–High trip Function and RCS integrity is ensured by the pressurizer safety valves.

The licensee stated that the proposed design of the high pressure EHC oil system allows for operator recovery actions from a decreasing EHC system pressure occurrence prior to a turbine trip (e.g., EHC system leakage). The EHC system low pressure alarm setpoint will have sufficient margin from the system trip setpoint. The high pressure EHC fluid "Low Pressure Alarm" occurs on decreasing pressure at 1600 psig and alerts the operator in the control room that the EHC fluid oil pressure is decreasing. The "Main Pump Auto Start" is initiated on decreasing pressure at 1500 psig and starts the backup EHC fluid oil pump to maintain pressure in the high pressure header to prevent a turbine trip (proposed nominal trip setpoint is 800 psig). An EHC fluid "Low-Low Pressure Alarm" occurs on decreasing pressure at 1350 psig and alerts the operator in the control room. This alarm allows for operator action to recover the EHC fluid oil pressure in response to the low pressure alarm and main pump auto start action. If EHC fluid oil pressure is not recovered by the time the pressure drops below 800 psig, the turbine will trip (as sensed by the two-out-of-three pressure switches) and the new low oil pressure switch

contacts will open to send a trip signal to the RPS if reactor power is above the P-9 power range neutron flux interlock (approximately 50% of full power).

The licensee reviewed possible failures associated with this new high pressure system and determined that a failure of the new switches will not result in any different outcome than a failure of the pressure switches in the existing design. The pressure switches are designed to fail conservatively, resulting in a turbine trip signal sent to the RPS system for the failed channel. The licensee stated that the turbine control system is independent of the turbine protection system. Hence, a failure in the turbine control system will not adversely affect the ability of the new pressure switches to perform their intended function. The licensee also stated that the piping in the high pressure EHC fluid oil header was evaluated and it was determined that no safety-related components would be adversely impacted; and the pressure switches will actuate on a low fluid oil pressure as designed to provide a signal to the RPS. The staff reviewed the proposed change and finds that the high pressure EHC system provides adequate protection against failures, therefore allowing the turbine trip on low fluid oil pressure to achieve its intended function. The NRC staff also finds the above discussion acceptable to meet GDC 13 because instrumentation is provided to monitor variables and systems over their anticipated ranges for the anticipated operational occurrence (reactor trip on turbine trip) and includes appropriate controls to maintain them within prescribed operating ranges.

The licensee stated that the proposed design change will install three new pressure switches having two output contacts that provide redundant inputs to each of the three RPS protection channels I, II, and III (two of three logic). The RPS logic is not affected by the change and the signal will still initiate a reactor trip on a turbine trip if reactor power is above the P-9 power range neutron flux interlock (approximately 50% of full power). The new low fluid oil header pressure switches do not provide any input into the turbine control system. The low fluid oil header pressure switches utilize the existing auxiliary relays to communicate with the RPS. The NRC staff finds the above discussion acceptable to meet GDC 20 because the protection system is not affected by the change, and therefore will continue to perform its design function to sense a turbine trip and automatically initiate an anticipatory reactor trip to minimize the reactor coolant system pressure and temperature transient for a loss of load transient.

The licensee stated that the existing low pressure AST fluid oil header pressure switches provides inputs to each of the three RPS protection channels I, II, and III (two-out-of-three logic) to initiate a reactor trip on a turbine trip if reactor power is above the P-9 power range neutron flux interlock. When the low oil pressure condition is sensed below the setpoint following a turbine trip by two-out-of-three pressure switches RPS Channel I, II, and III, the RPS initiates a reactor trip signal. Separation between the three pressure switches and associated wiring is provided in accordance with Institute of Electrical and Electronics Engineers (IEEE) standard IEEE 279-1971 and ensures independence between the RPS channels. The RPS trip function will now be performed by three new pressure switches located on the high pressure turbine EHC trip header.

As with the original pressure switches, the three new proposed EHC pressure switches have two output contacts that provide redundant inputs to each of the three RPS protection channels I, II, and III (two-out-of-three logic). The RPS logic is not affected by the change and the signal will still initiate a reactor trip on a turbine trip if reactor power is above the P-9 power range neutron flux interlock (approximately 50% of full power). Separation between the pressure switches for each RPS channel and associated wiring is maintained in accordance with IEEE 279-1971 and ensures independence between the RPS channels. The NRC staff finds

the above discussion acceptable to meet GDC 22 because there is no loss of the protection function of the turbine trip function into RPS from a low fluid oil pressure conditions.

The licensee stated that the normal operational state of the existing auto stop low fluid oil pressure switch is contacts closed. The contacts open when the fluid oil pressure drops below the setpoint. If the pressure switch fails, the contacts would open and therefore provide input to the associated RPS channel. The new low fluid oil header pressure switches are configured in the same manner as the existing auto stop low fluid oil pressure switches with contacts closed when EHC header pressure rises above the reset setpoint and contacts open when EHC header pressure drops below the trip setpoint. Pressure switch failure would result in the contact opening, providing input to the associated RPS channel in the same manner as an EHC header pressure drop below the trip setpoint. The NRC staff finds the above discussion acceptable to meet GDC 23 because, if a new proposed pressure switch fails, the contacts would open and therefore provide actuation input to the associated RPS channel.

Based on the above review, the NRC staff finds that the low pressure sensed on the EHC high pressure header following a turbine trip initiates an anticipatory reactor trip. The licensee does not credit this anticipatory reactor trip for protection of fission product barriers. The staff finds that the time interval between depressurization to trip logic initiation for the existing and the proposed trip systems is essentially the same, there are no changes in the electrical power design for the proposed change, the setpoint calculations are conservative, and the approved setpoint methodology was followed. The staff also finds that applicable requirements in the GDC and 50.36(c)(1)(A)(ii) will continue to be met. Based on its review, the NRC staff concludes that the proposed change to the low fluid oil pressure turbine trip setpoints is consistent with the guidance discussed in Section 2.4 of this SE and meets regulatory requirements, and is therefore acceptable.

3.2 Evaluation of the Surveillance Notes to TS Functions

The licensee also proposed to add footnotes (g) and (h), which would only be applicable to SR 3.3.1.10 for Table 3.3.1-1, Function 14a, "Low Fluid Oil Pressure." Differences between the WBN proposed wording and the TSTF-493 wording are noted below.

Proposed footnote (g):

TSTF-493 Option A	WBN
If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.	If the as found channel setpoint is outside its predefined as found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

The only difference between TSTF-493 and the WBN version is that the hyphen (-) has been removed from "as found" in two locations. The NRC staff finds this difference is editorial in nature and does not substantively change the requirement; therefore, the staff finds proposed footnote (g) acceptable.

Proposed footnote (h):

TSTF-493 Option A	WBN
The instrument channel setpoint shall reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The Nominal Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference.]	The instrument channel setpoint shall be reset to a value that is within the as left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. The methodologies used to determine the as found and as left tolerances for the NTSP are specified in FSAR Section 7.1.2.

One variation in the proposed WBN version is the omission of the following TSTF-493 text:

> Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The Nominal Trip Setpoint and...

In the LAR, the licensee stated the following regarding proposed footnote (h):

> Failure to set the actual plant trip setpoint to the NTSP (or more conservative than the NTSP), and within the acceptable as left tolerance, would invalidate the assumptions in the setpoint calculation because any subsequent instrument drift would not start from the expected as-left setpoint.
>
> ...
>
> In addition, incorporation of surveillance Note (h) for Table 3.3.1-1, Function 14.a. (TSTF-493-A Note 2) results in a more conservative requirement in that the allowance for the trip setpoints to be set more conservative than the NTSP explicitly requires that the as-found and acceptable as left tolerances apply to the actual setpoint implemented in the surveillance procedures to confirm channel performance.

The NRC staff reviewed the licensee's assessment and finds that the proposed footnote (h) wording is acceptable because (1) although the omitted text is a clarification, its omission does not change the original intent of TSTF-493 Note 2, and (2) the proposed SRs are better defined and more conservative because the channel would be declared inoperable if the channel setpoint cannot be reset to a value that is within the as-left tolerance.

Other identified differences from TSTF-493 are that the WBN version: (1) does not include the hyphen (-) in "as left" and "as found," (2) adds the specific licensing document (FSAR), and (3) "NTSP" is used instead of "Nominal Trip Setpoint" in the last sentence. The NRC staff

considers these to be editorial changes that do not substantively alter the footnote (h) requirement; therefore, the staff finds these differences to be acceptable.

The requirements of 10 CFR 50.36(c)(3) are met because the SRs will continue to 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.

3.3 Technical Conclusion

The low fluid oil pressure setpoint is not a limiting setpoint used to protect a design or licensing basis limiting condition. Although the reactor trip on turbine trip – low fluid oil pressure is not credited in any WBN design basis accident analyses, this anticipatory trip minimizes the effects of a reactor coolant pressure and temperature transient for a loss of load transient. The staff finds that the time interval between depressurization to trip logic initiation for the existing and the proposed trip systems is essentially the same, there are no changes in the electrical power design for the proposed change, the setpoint calculations are conservative, and the approved setpoint methodology was followed. The staff also finds that applicable requirements in the GDC and 50.36(c)(1)(A)(ii) will continue to be met. Based on the above review, the NRC staff finds the proposed changes to the allowable value and nominal trip setpoint specified in TS Table 3.3.1-1 for the turbine trip function above P-9, based on low fluid oil pressure from the EHC high pressure header, to be acceptable.

In addition, the NRC staff finds that addition of footnotes (g) and (h) to the SR for the reactor trip on turbine trip low fluid pressure are acceptable because the proposed notes require the evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance, but is conservative with respect to the AV, and requires the establishment of the appropriate as-found tolerance for each channel. The proposed note for the as-left tolerance is a more conservative requirement because the actual calibrated setpoint would become the new nominal trip setpoint implemented in the procedure associated with SR 3.3.1.10. These Notes are similar to TSTF-493-A Notes 1 and 2 and NUREG-1431, Revision 4, Table 3.3.1-1, function 16 a; Low Fluid Oil Pressure, footnotes (b) and (c), which the NRC staff previously found to be acceptable, and will ensure that 10 CFR 50.36(c)(3) requirements are met.

On the basis of its review, the NRC staff concludes that the proposed amendment is consistent with the guidance discussed in Section 2.4 of this SE and meets the regulatory requirements set forth in Section 2.3 of this SE, and is therefore 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 on February 27, 2018. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes SRs. 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 previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding published in the *Federal Register* on June 6, 2017 (82 FR 26140). 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. Letter dated March 16, 2017, from TVA to US NRC, Application to Modify the Watts Bar Nuclear Plant Unit 1 Technical Specification 3.3.1, Reactor Protection System Instrumentation, Turbine Trip Function on Low Fluid Oil Pressure (390-WBN-TS-17-01), Agencywide Documents Access and Management System (ADAMS), Accession No. ML17075A229.

2. Letter dated August 31, 2017, from TVA to US NRC, Response to Request for Additional Information Regarding Request to Modify Technical Specification 3.3.1, Reactor Protection System Instrumentation (CAC No. MF9401) ADAMS Accession No. ML17244A033.

3. Transmittal of Revised TSTF-493, Revision 4, "Clarify Application of Setpoint Methodology for LSSS [Limiting Safety System Setting] Functions," dated January 5, 2010, ADAMS Accession No. ML100060064.

4. NRC Notice of Availability of the Models for Plant-Specific Adoption of Technical Specifications Task Force Traveler TSTF-493, Revision 4, "Clarify Application of Setpoint Methodology for LSSS Functions," ADAMS Accession No. ML093410581.

5. Nuclear Quality Assurance Plan, TVA-NQA-PLN89-A, Revision 33, dated December 28, 2016, ADAMS Accession No. ML16363A392.

6. Regulatory Guide 1.105, "Setpoints for Safety-Related Instrumentation," Revision 3, December 1999, ADAMS Accession No. ML993560062.

7. Regulatory Issue Summary 2006-17, "NRC Staff Position on the Requirements of 10 CFR 50.36, Technical Specifications, Regarding Limiting Safety System Setting During Periodic Testing and Calibration of Instrument Channels," August 24, 2006, ADAMS Accession No. ML051810077.

8. NUREG-1431, Volume 1, Revision 4, "Standard Technical Specifications, Westinghouse Plants, Revision 4" published April 2012, ADAMS Accession No. ML12100A222.

9. US NRC email to TVA, dated August 11, 2017, Request for Additional Information Concerning Request to Amend Turbine Trip Low Fluid Oil Pressure Reactor Protection System Trip Setpoint (CAC No. MF9401), ADAMS Accession No. ML17226A003.

Principal Contributors: Larry Wheeler
Khadijah West

Date: March 28, 2018

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 - ISSUANCE OF AMENDMENT REGARDING REACTOR PROTECTION SYSTEM INSTRUMENTATION TURBINE TRIP FUNCTION (CAC NO. MF9401; EPID L-2017-LLA-0189) DATED MARCH 28, 2018

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