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

October 30, 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 2 – ISSUANCE OF AMENDMENT TO MODIFY TECHNICAL SPECIFICATION TABLE 3.3.1-1, "REACTOR TRIP SYSTEM INSTRUMENTATION," TURBINE TRIP FUNCTION ON LOW FLUID OIL PRESSURE (EPID L-2017-LLA-0357).

Dear Mr. Shea:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 22 to Facility Operating License No. NPF-96 for Watts Bar Nuclear Plant, Unit 2. This amendment is in response to your application dated October 11, 2017.

This amendment revises Technical Specification (TS) 3.3.1, 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 related safety evaluation is also enclosed. Notice of issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

Natreon Jordan, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-391

Enclosures:
1. Amendment No. 22 to NPF-96
2. Safety Evaluation

cc: Listserv

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

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-391

WATTS BAR NUCLEAR PLANT, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 22
License No. NPF-96

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

   A. The application for amendment by Tennessee Valley Authority (TVA) dated October 11, 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-96 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. 22 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 2 refueling outage, which is scheduled for spring 2019.

FOR THE NUCLEAR REGULATORY COMMISSION

Undine Shoop, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Facility Operating
License No. NPF-96 and
Technical Specifications

Date of Issuance: October 30, 2018

ATTACHMENT TO LICENSE AMENDMENT NO. 22

WATTS BAR NUCLEAR PLANT, UNIT 2

FACILITY OPERATING LICENSE NO. NPF-96

DOCKET NO. 50-391

Replace page 3 of Facility Operating License No. NPF-96 with the attached revised page 3.

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

REMOVE	INSERT
3.3-18	3.3-18

C. The 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 3411 megawatts thermal.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A as revised through Amendment No. 22 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) TVA shall implement permanent modifications to prevent overtopping of the embankments of the Fort Loudon Dam due to the Probable Maximum Flood by June 30, 2018.

(4) PAD4TCD may be used to establish core operating limits for Cycles 1 and 2 only. PAD4TCD may not be used to establish core operating limits for subsequent reload cycles.

(5) By December 31, 2018, the licensee shall report to the NRC that the actions to resolve the issues identified in Bulletin 2012-01, "Design Vulnerability in Electrical Power System," have been implemented.

(6) The licensee shall maintain in effect the provisions of the physical security plan, security personnel training and qualification plan, and safeguards contingency plan, and all amendments made pursuant to the authority of 10 CFR 50.90 and 50.54(p).

(7) TVA shall fully implement and maintain in effect all provisions of the Commission approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The TVA approved CSP was discussed in NUREG-0847, Supplement 28, as amended by changes approved by License Amendment No. 7.

(8) TVA shall implement and maintain in effect all provisions of the approved fire protection program as described in the Fire Protection Report for the facility, as described in NUREG-0847, Supplement 29, subject to the following provision:

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	1, 2	3/SG	U	SR 3.3.1.1 SR 3.3.1.7 (b)(c) SR 3.3.1.10 (b)(c) SR 3.3.1.15	≥ 16.4% of narrow range span	17% of narrow range span
Coincident with:						
a) Vessel ΔT Equivalent to power ≤ 50% RTP	1, 2	3	V	SR 3.3.1.7 (b)(c) SR 3.3.1.10 (b)(c)	Vessel ΔT variable input ≤ 52.6% RTP	Vessel ΔT variable input 50% RTP
With a time delay (T_s) if one steam generator is affected					≤ 1.01 T_s (Refer to Note 3, Page 3.3-23)	T_s (Refer to Note 3, Page 3.3-23)
or						
A time delay (T_m) if two or more steam generators are affected					≤ 1.01 T_m (Refer to Note 3, Page 3.3-23)	T_m (Refer to Note 3, Page 3.3-23)
b) Vessel ΔT Equivalent to power > 50% RTP with no time delay (T_s and T_m = 0)	1, 2	3	V	SR 3.3.1.7 (b)(c) SR 3.3.1.10 (b)(c)	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 (b)(c) 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)

(b) 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.

(c) 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. 22

TO FACILITY OPERATING LICENSE NO. NPF-96

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-391

1.0 INTRODUCTION

By letter dated October 11, 2017 (Reference 1), Tennessee Valley Authority (TVA or the licensee) proposed changes to the Technical Specifications (TSs) for Watts Bar Nuclear Plant, Unit 2 (WBN Unit 2). The proposed changes would revise WBN Unit 2 TS 3.3.1, "Reactor Trip System (RTS) Instrumentation," Table 3.3.1-1, "Reactor Trip System Instrumentation," to reflect plant modifications on the Reactor Protection System (RPS) Instrumentation associated with turbine trip on low fluid oil pressure. The proposed changes are due to the planned 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 proposed changes to the nominal trip setpoint (NTSP) and allowable value (AV) are needed due to the higher EHC system operating pressure. Specifically, the NTSP would be increased from 45 psig to 800 psig and the AV would be increased from greater than or equal to (≥) 38.3 psig to ≥ 710 psig.

On January 2, 2018, the U.S. Nuclear Regulatory Commission (NRC or the Commission) staff published a proposed no significant hazards consideration (NSHC) determination in the *Federal Register* (83 FR 171) for the proposed amendment. On March 13, 2018, the NRC staff published a second proposed NSHC determination in the *Federal Register* (83 FR 10924), which superseded the original determination in its entirety.

2.0 REGULATORY EVALUATION

2.1 System Description

The 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 limiting safety system settings in terms of parameters directly monitored by the RTS, as well as specifying limiting conditions for operation (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 power range neutron flux interlock setpoint of approximately 50 percent (%) of full power. Any turbine trip from a power level below the P-9 interlock setpoint will not directly trip the reactor, but will allow the RCS 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. This trip is included as part of good engineering practice and prudent design. No credit is taken in the accident analyses for this trip.

2.1.1 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 setpoint (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 existing AV is ≥ 38.3 psig.

2.1.2 Proposed Pressure Switch Configuration

The licensee specified in Reference 1 that modifications to the EHC system will remove the AST fluid oil header where the low oil pressure switches are located. To support this modification, the RPS trip function will instead 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 will 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 setpoint (approximately 50% of full power).

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 licensee specified that the proposed 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 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-three RPS channels. The circuitry associated with the pressure switches and the RPS is independent of the new turbine control system.

In accordance with the existing TS 3.3.1 for the RPS Instrumentation, the LCO requires three channels of Turbine Trip - Low Fluid Oil Pressure to be operable in Mode 1 above the P-9 power range neutron flux interlock setpoint. The licensee did not propose changing this LCO. Three channels will still be required to be operable above the P-9 interlock setpoint. Below the P-9 interlock setpoint, a turbine trip does not actuate a reactor trip. In Mode 2, 3, 4, 5, or 6, the P-9 interlock is not met and, therefore, there is no potential for a turbine trip. As a result, the Turbine Trip - Low Fluid Oil Pressure trip function does not need to be operable. Therefore, the new configuration will not impact the licensee's compliance with Section 50.36 of Title 10 of the *Code of Federal Regulations* (10 CFR) for having a TS provision for a reactor trip upon a turbine trip.

The licensee stated in Reference 1 that because the reactor trip on turbine trip function of the low fluid oil pressure is not credited in the accident analysis, the new pressure switches are quality related, non-seismic devices. Section 7.2.2.2 of the WBN Updated Final Safety Analysis Report (UFSAR) references UFSAR Chapter 17 for a discussion of component quality, which in turn references the TVA Nuclear Quality Assurance Plan, TVA-NQA-PLN89A (Reference 2), and "quality related" is defined in Appendix C of the latest revision of the plan. The new switches are similar to switches used in similar EHC applications at the Browns Ferry Nuclear Plant (BFN) on the turbine stop valves. The new switches are designed for consistent, dependable operation at the higher EHC fluid oil pressure. Operational experience at BFN has shown this style of switch to be reliable.

The licensee also specified in Reference 1, Section 3.2.4, "Nominal Trip Setpoint and Allowable Value Determination," that it has evaluated and confirmed that the proposed WBN Unit 2 AV of ≥ 710 psig ensures that sufficient margin exists to the analytical limit (AL) to account for unmeasurable uncertainties such as process effects to ensure that the protective action is performed under worst-case conditions before the analytical limit is exceeded when the channel is reset to within the as-left tolerance. Because an AL or safety limit is not defined for the low oil pressure trip function, the AV is derived from the NTSP in accordance with TVA Branch Technical Instruction BTI-EEB-TI-28, "Setpoint Calculations."

The licensee specified 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," as endorsed in NRC Regulatory Guide (RG) 1.105, Revisions 2 and 3, respectively (Reference 3). Although the new pressure switches are considered nonsafety 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 new pressure switches.

2.2 Proposed TS Changes

The licensee plans 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 fluid oil header that operates at a nominal control pressure of 2000 psig. The licensee stated in Reference 1 that the proposed changes to the NTSP and AV are needed due to the higher EHC system operating pressure. The licensee stated that relocation of the pressure switches to the high pressure turbine EHC fluid oil 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. The licensee stated that this change does not affect any RPS trip functions.

The licensee proposed the following changes to the AV and NTSP of WBN Unit 2 TS Table 3.3.1-1:

The existing TS states (in part):

FUNCTION	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
14. Turbine Trip a. Low Fluid Oil Pressure	≥ 38.3 psig	45 psig

The proposed TS would state (in part):

FUNCTION	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
14. Turbine Trip a. Low Fluid Oil Pressure	≥ 710 psig	800 psig

As shown above, for turbine trip, low fluid oil pressure, the AV would be changed from ≥ 38.3 psig to ≥ 710 psig, and the NTSP would be changed from 45 psig to 800 psig.

2.3 Regulatory Requirements

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

The WBN UFSAR provides a discussion of the design features and procedures that meet the intent of the design criteria, including a discussion of any exceptions to the GDC. The GDC that are relevant to this license amendment request 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, "Technical specifications." 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 system settings, and limiting control settings; (2) Limiting conditions for operation; (3) Surveillance requirements; (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.

2.4 Regulatory Guidance

RG 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation" (Reference 3), describes a method acceptable to the NRC staff for complying with the NRC regulations for ensuring that setpoints for safety-related instrumentation are initially within and remain within the TS limits. 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, Revision 6, "Guidance on Establishing and Maintaining Instrument Setpoints" (Reference 4), provides guidance for

NRC staff to review the bases for instrument setpoints. It 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.

A properly established setpoint initiates a plant protective action before the process parameter exceeds its analytical limit. This, in turn, ensures that the transient will be avoided and/or terminated before the process parameters exceed the established safety limits. Similar calculations and reviews are performed as necessary to verify the setpoints for functions that are not related to a safety limit or for nonsafety systems or procedural action points for safety and nonsafety systems.

The NRC staff also considered guidance in NUREG-1431, Revision 4, "Standard Technical Specifications [STS], Westinghouse Plants" (Reference 5).

3.0 TECHNICAL EVALUATION

3.1 Evaluation of the New Pressure Switch Configuration

On a turbine trip initiation signal, EHC dump valves connected to the EHC fluid oil header are signaled to open, draining the EHC fluid oil from the piping. The EHC header pressure decreases rapidly, thereby closing the turbine stop valves and tripping the turbine. The decreased EHC fluid oil 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 setpoint (approximately 50% of full power).

The licensee specified that the new pressure switch 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 setpoint (approximately 50% of full power).

The licensee specified that it has evaluated and confirmed that an AV of ≥ 710 psig is sufficient to account for uncertainties for the new pressure switch configuration in accordance with TVA Branch Technical Instruction BTI-EEB-TI-28. 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.

In Reference 1, TVA stated that there is no discernable difference in the time interval from depressurization to trip logic initiation between the current AST oil system configuration and the new high pressure turbine EHC oil system configuration.

The UFSAR does not contain any response time requirements for the initiation of this trip. The reactor trip on a turbine trip function from the low oil pressure switches response times 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 AST 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 specified that with the existing EHC configuration, the AST 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 AST oil line solenoid and emergency trip valves and depressurizes the AST 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 AST oil line is also ≤ 0.75 seconds.

The licensee specified 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 AST line, the time to directly depressurize the high-pressure EHC emergency trip header is expected to be the same or less 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 new EHC configuration, 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 the 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 new configurations is essentially the same and there are no negative effects.

The licensee stated in Reference 1 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 each switch. 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 the SSPS Train A. Power to the second set of contacts on each pressure switch is from the 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 the new configuration.

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 autostop 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 which change position when the turbine stop valves close or when the turbine autostop oil pressure goes below its setpoint.

The licensee stated in Reference 1 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 2. The selection of this value is consistent with NUREG-1431 (STS 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. In Reference 1, the licensee stated that performance data were used to evaluate the AV instead of total loop uncertainty because there is no associated AL 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 as-found tolerance (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 at WBN Unit 2 and finds them to be 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 EHC 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 the P-9 interlock setpoint. 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.

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 NTSP 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 from performing their function. The licensee also stated that the piping in the new high pressure EHC fluid oil header was evaluated and it was determined that no safety-related components would be adversely impacted; 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 new 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 since 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 RCS 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.

flux interlock setpoint. 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.

In the new configuration, 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 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 setpoint (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 AST 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 pressure switches are configured in the same manner as the existing 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 pressure switch fails, the contacts would open and, therefore, provide actuation input to the associated RPS channel (i.e., the system is designed to fail into a safe state).

Based on the above review, the NRC staff finds that, with the new configuration, 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 also finds that the applicable requirements in the GDC and 50.36(c)(1)(A)(ii) will continue to be met.

3.2 Technical Conclusion

Based on the above review, the NRC staff finds that the proposed changes to the WBN Unit 2 TS Table 3.3.1-1 AV and NTSP for the turbine trip function above the P-9 interlock setpoint, based on low fluid oil pressure from the EHC high pressure header, are acceptable. 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 Unit 2 design basis accident analyses, this anticipatory trip would minimize the effects of a reactor coolant pressure and temperature transient for a loss of load transient.

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 safety evaluation and meets the regulatory requirements set forth in Section 2.3 of this safety evaluation, 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 September 27, 2018. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to the installation or use of facility components 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 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 March 13, 2018 (83 FR 10924). 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 from Tennessee Valley Authority to U.S. Nuclear Regulatory Commission, "Application to Modify the Watts Bar Nuclear Plant Unit 2 Technical Specification 3.3.1, Reactor Protection System Instrumentation, Turbine Trip Function on Low Fluid Oil Pressure (391-WBN-TS-17-23)," dated October 11, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17284A452).

2. Letter from Tennessee Valley Authority to U.S. Nuclear Regulatory Commission, "Nuclear Quality Assurance Plan, TVA-NQA-PLN89-A, Revision 33," dated December 28, 2016 (ADAMS Accession No. ML16363A392).

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

4. NUREG-0800, Branch Technical Position 7-12, "Guidance on Establishing and Maintaining Instrument Setpoints," Revision 6, August 2016 (ADAMS Accession No. ML16019A200).

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

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Date: October 30, 2018

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 2 – ISSUANCE OF AMENDMENT TO MODIFY TECHNICAL SPECIFICATION TABLE 3.3.1-1, "REACTOR TRIP SYSTEM INSTRUMENTATION," TURBINE TRIP FUNCTION ON LOW FLUID OIL PRESSURE (EPID L-2017-LLA-0357) DATED OCTOBER 30, 2018

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