



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

May 28, 2015

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

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 - ISSUANCE OF AMENDMENT TO
MODIFY THE TECHNICAL SPECIFICATIONS REGARDING REACTOR
COOLANT PUMP MOTOR FLYWHEEL EXAMINATION PERIODICITY
(TAC NO. MF4525)

Dear Mr. Shea:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 99 to Facility Operating License No. NPF-90 for Watts Bar Nuclear Plant, Unit 1. This amendment consists of changes to the license in response to your application dated July 24, 2014.

The proposed amendment will revise the Technical Specifications regarding the frequency of performing inspections of the reactor coolant pump motor flywheel.

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

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

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

Docket No. 50-390

Enclosures:

1. Amendment No. 99 to NPF-90
2. Safety Evaluation

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

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-390

WATTS BAR NUCLEAR PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 99
License No. NPF-90

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Tennessee Valley Authority (the licensee) dated July 24, 2014, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

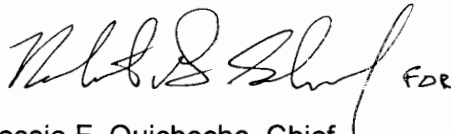
2. Accordingly, the license and Technical Specifications are amended by changes as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. NPF-90 is hereby amended to read as follows:

- (2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A as revised through Amendment No. 99 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 60 days after the issuance date.

FOR THE NUCLEAR REGULATORY COMMISSION



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

Attachment:
Changes to the Operating License

Date of Issuance: May 28, 2015

ATTACHMENT TO LICENSE AMENDMENT NO. 99

FACILITY OPERATING LICENSE NO. NPF-90

DOCKET NO. 50-390

Replace the following pages of Facility Operating License NPF-90 with the attached revised pages. The revised pages are identified by amendment number and contain a marginal line indicating the area of change.

REMOVE

3

5.0-14

INSERT

3

5.0-14

- (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. 99 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.

5.7 Procedures, Programs, and Manuals (continued)

5.7.2.10 Reactor Coolant Pump Flywheel Inspection Program

This program shall provide for the inspection of each reactor coolant pump flywheel per the recommendations of Regulation Position c.4.b of Regulatory Guide 1.14, Revision 1, August 1975.

In lieu of Position C.4.b(1) and C.4.b(2), a qualified in-place UT examination over the volume from the inner bore of the flywheel to the circle one-half of the outer radius or a surface examination (MT and/or PT) of exposed surfaces of the removed flywheels may be conducted at 20 year intervals.

5.7.2.11 Inservice Testing Program

This program provides controls for inservice testing of ASME Code Class 1, 2, and 3 components. The program shall include the following:

- a. Testing frequencies applicable to the ASME Code for Operations and Maintenance of Nuclear Power Plants (ASME OM Code) and applicable Addenda as follows:

ASME OM Code and applicable Addenda terminology for inservice testing activities	Required Frequencies for performing inservice testing activities
Weekly	At least once per 7 days
Monthly	At least once per 31 days
Quarterly or every 3 months	At least once per 92 days
Semiannually or every 6 months	At least once per 184 days
Every 9 months	At least once per 276 days
Yearly or annually	At least once per 366 days
Biennially or every 2 years	At least once per 731 days

- b. The provisions of SR 3.0.2 are applicable to the above required Frequencies and other normal and accelerated Frequencies specified as 2 years or less in the Inservice Testing Program for performing inservice testing activities;
- c. The provisions of SR 3.0.3 are applicable to inservice testing activities; and
- d. Nothing in the ASME OM Code shall be construed to supersede the requirements of any TS.

(continued)



UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 99 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 July 24, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14210A051), the Tennessee Valley Authority (TVA, the licensee) submitted a license amendment request regarding Watts Bar Nuclear Plant, Unit 1 (WBN-1) Technical Specifications (TSs). The proposed amendment would revise TS 5.7.2.10, "Reactor Coolant Pump [RCP] Flywheel Inspection Program," to extend the RCP motor flywheel examination to a 20-year interval.

This change is in accordance with Revision 0 of Technical Specification Task Force (TSTF) Traveler 421, "Revision to RCP Flywheel Inspection Program (WCAP-15666)." The purpose of a TSTF is to make improvements to the standard TSs. Once a TSTF is approved, a licensee may apply to incorporate it into the TSs by providing a plant-specific justification acceptable to the U.S. Nuclear Regulatory Commission (NRC) staff. The TSTF process improves the efficiency of the licensing process by allowing the staff to review and approve a proposed change that will be used and referenced in preparation of license amendment requests by multiple licensees. In the case of TSTF-421, this generic change extended the allowable inspection interval related to RCP flywheel inspections to 20 years. A notice announcing the availability of this proposed TS change using the consolidated line item improvement process was published in the *Federal Register* on October 22, 2003 (68 FR 60422).

The licensee has reviewed the NRC staff's model safety evaluation (SE), as well as the information provided to support TSTF-421, including Topical Report (TR) WCAP-15666, "Extension of Reactor Coolant Pump Motor Flywheel Examination" (ADAMS Accession No. ML012420149) and the related SE dated May 5, 2003 (ADAMS Accession No. ML031250595). The licensee's evaluation concluded that the justifications presented in the TSTF proposal and the model SE prepared by the staff are applicable to WBN-1 and justify this amendment for the incorporation of the changes to the WBN-1 TSs. Typically, when requesting the generic changes approved in TSTF-421, the licensee has already incorporated the changes of TSTF-237, "Revision to RCP Flywheel Inspection Program (WCAP-14535)." The title of WCAP-14535 is, "Topical Report on Reactor Coolant Pump Flywheel Inspection Elimination" and it provided justification for extending and/or eliminating the inspection interval of RCP

flywheels. TSTF-237 provided the original extension of inspection intervals for RCP flywheels (from 3 to 10 years), while TSTF-421 added additional time to the inspection interval (from 10 to 20 years). The change in TSTF-421 simply modifies a paragraph added by TSTF-237. Since the licensee had not yet adopted TSTF-237, the staff needed to review the applicability of both TSTF-237 and TSTF-421 in order to reach its safety conclusion.

2.0 REGULATORY EVALUATION

The function of the RCP in the reactor coolant system (RCS) of a pressurized-water reactor plant is to maintain an adequate cooling flow rate by circulating a large volume of primary coolant water at high temperature and pressure through the RCS. Following an assumed loss of power to the RCP motor, the flywheel, in conjunction with the impeller and motor assembly, provides sufficient rotational inertia to assure adequate primary coolant flow during RCP coastdown, thus resulting in adequate core cooling. Regulatory Guide (RG) 1.14, "Reactor Coolant Pump Flywheel Integrity," Revision 1, August 1975, describes a method acceptable to the staff with regard to minimizing the potential for failures of the flywheels of RCP motors in light-water-cooled power reactors. As noted in Section B, Discussion, of RG 1.14:

If the flywheel of the reactor coolant pump is conservatively designed and made from suitable materials with closely controlled quality, if adequate design review of new configurations is provided, and if adequate inservice inspection is provided, the probability of a flywheel failure is sufficiently small that the consequences of failure need not be protected against.

The inspections discussed in RG 1.14 are incorporated into the WBN-1 TS 5.7.2.10. Specifically, TS 5.7.2.10 requires the licensee to maintain a program that provides for the inspection of each RCP flywheel per the recommendations of Regulatory Position c.4.b of RG 1.14. As stated in RG 1.14, Regulatory Position c.4.b gives the following five requirements for inservice inspection for each RCP flywheel: (1) triannual in-place ultrasonic exams of certain areas of higher stress concentration, (2) a surface examination, and complete ultrasonic volumetric examination every 10 years, (3) exam procedures should meet Subarticle IWA-2200 of Section XI of the ASME Code [American Society of Mechanical Engineers Boiler and Pressure Vessel Code], (4) acceptance criteria should conform to the recommendations of Regulatory Position C.2.f. (C.2.f describes how to appropriately design normal flywheel speeds), (5) submission of the results of the examination and evaluation to the NRC staff where warranted.

The licensee proposed an exception to the triannual exams and surface and ultrasonic testing (UT) exams listed above with a UT exam every 20 years. Specifically, the licensee proposed to add the following as the second paragraph to TS 5.7.2.10, "Reactor Coolant Pump Flywheel Inspection Program":

In lieu of Position C.4.b(1) and C.4.b(2), a qualified in-place UT examination over the volume from the inner bore of the flywheel to the circle one-half of the outer radius or a surface examination (MT and/or PT) of the exposed surfaces of the removed flywheels may be conducted at 20 year intervals.

This change is similar to TSTF-237, Revision 1, "Relaxation of Reactor Coolant Pump Flywheel Examinations." TSTF-237 sought to use the operational experience and data provided in Westinghouse WCAP-14535 to eliminate the inspection requirements of RCP flywheels. The NRC staff determined that while they could not eliminate the need for inspection due to the consequences of a failed flywheel, WCAP-14535 had provided enough information to extend the inspection interval to 10 years. The justification for a change in TSTF-237 is based on an NRC-issued SE, dated September 12, 1996, for WCAP-14535. This SE was included in the approved version of the TR, WCAP-14535A. In its SE, the NRC staff concluded that adding the following paragraph to plants that meet the applicability requirements described in the SE is justified:

In lieu of Position C.4.b(1) and C.4.b(2), a qualified in-place UT examination over the volume from the inner bore of the flywheel to the circle one-half of the outer radius or a surface examination (MT [magnetic particle testing] and/or PT [liquid penetrant testing]) of the exposed surfaces of the removed flywheels may be conducted at approximately 10-year intervals coinciding with the Inservice Inspection schedule as required by ASME Section XI.

The conclusions of TSTF-237 were based in large part on the material used to manufacture the RCP flywheel. Depending on the material used, the appropriate application of the NRC staff's conclusions would vary. For the TSTF-237 related changes, the NRC SE for WCAP-14535 stated that licensees who planned to submit a plant-specific application of the TR for flywheels made of SA-533 Grade B material needed to confirm that their flywheels are made of SA-533 Grade B material. Further, licensees having Group 15 flywheels needed to demonstrate that material properties of their A516 material are equivalent to SA-533 Grade B material, and that its reference temperature, RT_{NDT} , is not less than 30 degrees Fahrenheit. If the licensee confirmed these technical justifications as part of its application for the TS change, then the NRC staff could apply its conclusions from the September 12, 1996, SE to the application.

As stated previously, TSTF-421 builds on the technical and regulatory bases of TSTF-237. Specifically, TSTF-421 further extends the allowed inspection interval to 20 years. The justification for the proposed change in accordance with TSTF-421 was provided by WCAP-15666, which the NRC staff accepted for referencing in license applications by a letter and SE dated May 5, 2003. The TR addresses the three critical speeds defined in RG 1.14: (a) the critical speed for ductile failure, (b) the critical speed for non-ductile failure, and (c) the critical speed for excessive deformation of the flywheel. The NRC staff found that the methodologies in the TR adequately addressed these issues and demonstrated that acceptance criteria, for normal and accident conditions defined in RG 1.14 would continue to be met for all domestic Westinghouse plants following an extension of the inspection interval. The TR also provided a risk assessment for extending the RCP flywheel inspection interval. The NRC staff's review, documented in the SE for the TR, determined that the analysis methods and risk estimates are acceptable when compared to the guidance in RG 1.174.

3.0 TECHNICAL EVALUATION

The NRC staff's method of review is to compare TVA's requested changes to similar changes the NRC staff reviewed generically through TSTF-237 and TSTF-421. These changes are discussed below.

3.1 TSTF-237 Related Changes

The licensee's proposed change, stated in Section 2.0 above, was originally reviewed by the NRC as part of the review of WCAP-14535 and subsequently became part of TSTF-237. There is one slight difference between the licensee's requested paragraph insertion and the paragraph in TSTF-237, which is the prescribed time for the inspection interval. In TSTF-237, this timeframe was only 10 years, not the proposed 20 years. Therefore, as a first step, the NRC staff needed to confirm that the regulatory positions in conclusions made in TSTF-237 were applicable to the licensee.

The original intent of TR WCAP-14535 was to eliminate the examination of RCP flywheels entirely. In its review of WCAP-14535, the NRC staff determined that operating experience and vendor testing had shown that the RCP flywheel was designed to be more robust than originally understood, as long as certain material specifications were met. The staff disagreed that inspections could be eliminated altogether. However, the NRC staff concluded that the inspection interval may be extended to 10 years, provided that the flywheels were made of SA-533 B material and the flywheel does not belong to Groups 10 and 15 as described in WCAP-14535. The details of this review and conclusions can be found in the NRC staff's SE dated September 12, 1996.

The WBN-1 Updated Final Safety Analysis Report, Revision 11, November 2014, Section 5.2.6.2, "Fabrication and Inspection," states each flywheel plate is fabricated from SA-533, Grade B, Class 1 steel, and meets the requirements of RG 1.14. Therefore, the plant-specific applicability of WCAP-14535 and TSTF-237 to WBN-1 is confirmed, and the 10-year inspection requirement stated in Section 2.0 above is acceptable.

3.2 TSTF-421 Related Changes

The portion of the proposed change related to TSTF-421 is the duration of the interval. The NRC staff needed to review the application to confirm that the licensee had met the applicability requirements of TSTF-421, so that the NRC staff's generic conclusions for TSTF-421 could be applied to the licensee's plant.

The purpose of TR WCAP-15666 was to further extend the inspection interval for RCP flywheels in applicable pressurized water reactors based on risk-informed conclusions. In its SE dated May 5, 2003, the NRC explained that the failure of the RCP flywheel is determined by the presence of a crack large enough that, if subjected to the stresses caused by a given speed, will cause the flywheel to fail. The NRC staff examined the bounding scenarios that generate stresses that could cause an RCP flywheel to fail and determined that the largest possible stresses would be expected to occur when there is a double-ended guillotine break loss of coolant accident with a simultaneous loss of power to the RCP motor. Additionally, the NRC staff concluded that based on the conservative application of ASME crack-growth formulae over

a period of 20 years to an assumed initial crack length of 10 percent of the distance from the keyway to the flywheel outer radius, the largest final crack still met the ASME Code, Section XI acceptance criteria.

WCAP-15666 described the critical crack length for failure of the RCP flywheel based on ASME Code formulae for crack growth. The NRC staff reviewed the provided information and found it to be acceptable for the three speeds that the RCP flywheel may experience during its lifetime: (1) normal operation, (2) a transient or LOCA, and (3) the bounding case of the double-ended guillotine break combined with a loss of power to the RCP motor. The TR conservatively used the critical crack length for the bounding speed for all speeds to determine whether there was a significant risk increase per year if the crack were allowed to grow unchecked. For each speed, the risk for RCP flywheel failure caused by cracking was calculated and found to be negligible if the RCP flywheel were inspected every 20 years instead of every 10 years. It was also negligible when compared to an inspection level of every 3 years as required by RG 1.14 prior to the NRC staff's acceptance of WCAP-14535. The details of the NRC staff's review and conclusions can be found in the SE dated May 5, 2003.

The NRC staff concluded that the assumptions provided in WCAP-15666 were conservative and that the risk estimates applied in the TR showed that there was a negligible increase in risk associated with increasing the interval to 20 years, compared with the original positions of RG 1.14. The potential for failure of the RCP flywheel is, and will continue to be, negligible during normal and accident conditions. The NRC SE dated May 5, 2003, found WCAP-15666 acceptable without any limitations or conditions.

WCAP-15666 proposed specific TS changes as stated in Section 4 of the report. Included among them was a revision to the second paragraph of Standard TS 5.5.7, "Reactor Coolant Pump Flywheel Inspection Program":

In lieu of Position C.4.b(1) and C.4.b(2), a qualified in-place UT examination over the volume from the inner bore of the flywheel to the circle one-half of the outer radius or a surface examination (MT [magnetic particle testing] and/or PT [liquid penetrant testing]) of the exposed surfaces of the removed flywheels may be conducted at approximately ~~10-year intervals coinciding with the Inservice Inspection schedule as required by ASME [American Society of Mechanical Engineers] Section XI~~ 20-year intervals.

WCAP-15666 modified WCAP-14535 (TSTF-237) by increasing the inspection interval to 20 years. Since the licensee-proposed changes as stated in Section 2.0 of this SE, aligned with the NRC-approved WCAP-15666 changes, the NRC staff finds them acceptable.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in Title 10 of the *Code of Federal Regulations* (10 CFR), Part 20, and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments on this topic involve no significant hazards consideration, and there was no public comment on such finding (79 FR 58827; September 30, 2014). 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.

Principal Contributors: Khadijah N. West
Anthony J. Minarik

Date: May 28, 2015

May 28, 2015

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

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Sincerely,

/RA/

Jeanne A. Dion, Project Manager
Watts Bar Special Projects Branch
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Docket No. 50-390

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2. Safety Evaluation

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