

June 9, 1998

Mr. O. J. Zeringue  
Chief Nuclear Officer  
and Executive Vice President  
Tennessee Valley Authority  
6A Lookout Place  
1101 Market Street  
Chattanooga, Tennessee 37402-2801

SUBJECT: ISSUANCE OF AMENDMENT ON HYDROGEN MITIGATION SYSTEM, WATTS  
BAR NUCLEAR PLANT, UNIT 1 (TAC NO. MA1491)

Dear Mr. Zeringue:

The Commission has issued the enclosed Amendment No.10 to Facility Operating License No. NPF-90 for Watts Bar Nuclear Plant, Unit 1. This amendment is in response to your application dated April 29, 1998. The requested changes would allow, temporarily, both trains of hydrogen igniters to be declared inoperable for up to 72 hours.

The condition prompting submittal of the application was the discovery of two inoperable "A" train hydrogen igniters on April 3, 1998. On April 9, 1998 you submitted a letter providing background information for a later potential request for an NRC Notice of Enforcement Discretion (NOED) in the event of a coincident failure of the monthly "B" train diesel-generator test to be completed in a four hour interval while the two "A" train igniters remained inoperable. The delay from April 3 until April 29, 1998, in submitting the related license amendment application resulted in a condition wherein, absent other justifications, neither the emergency nor exigent provisions of 10 CFR 50.91 would have been appropriate for processing the application. In the event of the above mentioned coincidence, the staff would have considered any request for a NOED consistent with the criteria for issuance of a NOED. However, as noted in the NRC's Inspection Manual, Part 9900, the NRC staff expects to issue NOEDs infrequently and is under no obligation to issue a NOED merely because a licensee requests one. Thus, in the event that the circumstances did not meet the criteria for a NOED, the plant could have experienced a required shutdown, with the resulting transient aspects of the shutdown and startup, due to TVA's lack of timeliness in submitting its application for a license amendment to address this issue.

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

Sincerely,  
Original signed by:  
Robert E. Martin, Senior Project Manager  
Project Directorate II-3  
Division of Reactor Projects - I/II  
Office of Nuclear Reactor Regulation

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Docket No. 50-390  
Enclosures: 1. Amendment No. 10 to NPF-90  
2. Safety Evaluation

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cc w/enclosures: See next page

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Mr. O. J. Zeringue  
Tennessee Valley Authority

**WATTS BAR NUCLEAR PLANT**

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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. 10  
License No. NPF-90

1. The Nuclear Regulator Commission (the Commission) has found that:
  - A. The application for amendment by Tennessee Valley Authority (the licensee) dated April 29, 1998, 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 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:

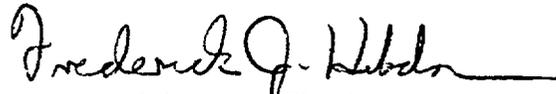
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(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 10 , 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, to be implemented no later than 30 days of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Frederick J. Hebdon, Director  
Project Directorate II-3  
Division of Reactor Projects - I/II  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: June 9, 1998

ATTACHMENT TO AMENDMENT NO. 10  
FACILITY OPERATING LICENSE NO. NPF-90  
DOCKET NO. 50-390

Revise the Appendix A Technical Specifications by removing the pages identified below and inserting the enclosed pages. The revised pages are identified by the captioned amendment number and contain marginal lines indicating the area of change.

Remove Pages

3.6-22  
3.6-23  
B 3.6-54  
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Insert Pages

3.6-22  
3.6-23  
B 3.6-54  
B 3.6-54a

3.6 CONTAINMENT SYSTEMS

3.6.8 Hydrogen Mitigation System (HMS)

LCO 3.6.8 Two HMS trains shall be OPERABLE. (\* See Note below)

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One HMS train inoperable.  * See Note below	A.1 Restore HMS train to OPERABLE status.  <u>OR</u> A.2 Perform SR 3.6.8.1 on the OPERABLE train.	7 days  Once per 7 days
B. One containment region with no OPERABLE hydrogen ignitor.  * See note below	B.1 Restore one hydrogen ignitor in the affected containment region to OPERABLE status.	7 days
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

\* NOTE  
For the time period between June 9, 1998, and the next WBN Unit 1 entry into MODE 3, HMS Train A is considered OPERABLE with 32 of 34 ignitors OPERABLE. The following additional CONDITION and REQUIRED ACTION applies:

CONDITION

Reactor Cavity Region (Hydrogen Ignitors 30A and 46B) and Steam Generator No. 4 Enclosure Lower Compartment Region (Hydrogen Ignitors 31A and 45B) with no OPERABLE hydrogen ignitor.

REQUIRED ACTION/COMPLETION TIME

Restore one hydrogen ignitor in each region to OPERABLE status within 72 hours.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.8.1	Energize each HMS train power supply breaker and verify $\geq 33^*$ ignitors are energized in each train.  * See Note below	92 days*
SR 3.6.8.2	Verify at least one hydrogen ignitor is OPERABLE in each containment region.	92 days
SR 3.6.8.3	Energize each hydrogen ignitor and verify temperature is $\geq 1700^\circ\text{F}$ .	18 months

\*

NOTE

For the time period between June 9, 1998, and the next WBN unit 1 entry into MODE 3, SR 3.6.8.1 shall verify  $\geq 32$  ignitors are OPERABLE on HMS Train A at a frequency of 46 days.

**BASES**

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**SURVEILLANCE  
REQUIREMENTS**

SR 3.6.8.3 (continued)

experience has shown that these components usually pass the SR when performed at the 18 month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

TEMPORARY CONDITION

LCO 3.6.8 is modified by Notes that provide temporary requirements for the HMS due to a condition discovered on April 3, 1998, wherein two Train A ignitors (30A and 31A) were found inoperable during surveillance testing. The ignitors are located in high radiation and temperature areas of Unit 1 containment and should be repaired with the reactor offline to avoid personnel safety hazards associated with making repairs online. The Notes are justified in Reference 4 on the basis the HMS will still be capable of performing its intended function. The Notes establish the following for the temporary period:

- (1) This temporary specification will expire at WBN's next entry into MODE 3.
- (2) The BASES of LCO 3.6.8 on page B 3.6-51 is modified by defining that HMS Train A is considered OPERABLE with 32 of 34 ignitors OPERABLE. This allowance is only permitted for the condition where ignitors 30A and 31A are the only inoperable A-train ignitors.
- (3) CONDITION B of LCO 3.6.8 is modified to allow two specific containment regions (Reactor Cavity Region and Steam Generator No. 4 Enclosure Lower Compartment Region) to have no OPERABLE ignitors for a period up to 72 hours.
- (4) SR 3.6.8.1 is modified to permit  $\geq 32$  ignitors energized for HMS Train A to demonstrate operability. The testing must be performed at an increased frequency of 46 days.

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**REFERENCES**

1. Title 10, Code of Federal Regulations, Part 50.44, "Standards for Combustible Gas Control Systems in Light Water-Cooled Power Reactors."

**BASES**

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2. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 41, "Containment Atmosphere Cleanup."
  3. Watts Bar FSAR, Section 6.2.5A, "Hydrogen Mitigation System Description."
  4. TVA letter to NRC from P. L. Pace, "WBN Unit 1 - Request for TS Amendment for TS 3.6.8 - Hydrogen Mitigation System (HMS) (TS-98-011)," April 29, 1998.
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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO.10 TO FACILITY OPERATING LICENSE NO. NPF-90

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-390

1.0 INTRODUCTION

By letter dated April 29, 1998, the Tennessee Valley Authority (the licensee) submitted a request for changes to the Watts Bar Nuclear Plant, Unit 1 (WBN), Technical Specifications (TS). The requested changes would allow, temporarily, both trains of hydrogen igniters to be declared inoperable for up to 72 hours.

WBN is a Westinghouse 4-Loop pressurized water reactor, with an ice condenser type containment. During routine surveillance testing on April 3, 1998, WBN discovered 2 of the 34 hydrogen igniters in Train A inoperable, which rendered Train A of the Hydrogen Mitigation System (HMS) inoperable. The affected igniters are located in a high radiation and temperature area of the lower containment and can't be repaired until the reactor is taken offline. Failure of the emergency diesel generator (EDG) 1B-B to pass its surveillance test could result in loss of emergency power to the Train B igniters, rendering both trains of the HMS inoperable. This condition (or a loss of normal power to Train B igniters) would require WBN to enter limiting condition for operation (LCO) 3.0.3 which initiates shutdown of the plant. To avoid this condition, TVA requested a temporary TS amendment until the next WBN entry into Mode 3. WBN's next scheduled outage is for refueling in February 1999.

The proposed temporary license amendment would revise TS LCO 3.6.8 to provide temporary requirements for the hydrogen igniters. The temporary specification would apply until the next shutdown to MODE 3 following which time igniter repair(s) would be performed to restore the system to OPERABLE status. Specifically, LCO 3.6.8 would be revised with temporary notes which:

- (1) Define HMS Train A as OPERABLE with 32 of 34 igniters OPERABLE, instead of 33 of 34.
- (2) Address a condition and required action for two specific containment regions (Reactor Cavity and Steam Generator (SG) No. 4 Enclosure Lower Compartment) simultaneously having no operable igniters. At least one igniter in each region would require restoration within 72 hours.
- (3) Provide for an increased surveillance frequency from 92 days to 46 days for HMS Train A.

Enclosure

## 2.0 Evaluation

The HMS consists of two groups of 34 redundant hydrogen igniters distributed throughout various areas of the WBN containment that are designed to burn hydrogen in a controlled manner at the lower flammability concentration following a degraded core accident. The HMS must be capable of handling an amount of hydrogen equivalent to that generated from a metal water reaction involving 75% of the fuel cladding surrounding the active fuel region. An igniter train is currently considered OPERABLE with at least 33 of 34 igniters in service and each containment region having at least one OPERABLE igniter. The licensee's proposed TS change would continue to ensure that at least one group of OPERABLE igniters is available unless a loss of Train B power were to occur. In that case, the proposed TS change would permit the reactor cavity and SG No. 4 lower compartment enclosure regions to have no operable igniters for a duration of 72 hours during which time power must be restored or a plant shutdown to MODE 3 achieved within the following 6 hours. This evaluation will consider the ability of the Train A igniters, less igniter 30A (reactor cavity) and 31A (SG No. 4 lower compartment), to provide adequate coverage of the containment for a period of 72 hours.

Regulatory guidance documents such as the Standard Review Plan and associated Regulatory Guides do not provide specific criteria regarding the locations of hydrogen igniters in those containments using igniter systems to comply with 10 CFR 50.44 requirements. The igniter locations at ice condenser facilities have been selected with a view toward providing coverage near hydrogen sources and in compartments where hydrogen could accumulate in both high locations and low locations. High locations have been included to account for the possibility of hydrogen pocketing at high points due to buoyancy. Low locations have been included to take advantage of upward burning in leaner mixtures. Igniter coverage is also provided in areas where low-concentration hydrogen mixtures could be rapidly concentrated into combustible mixtures due to ice or spray cooling effects (e.g., upper plenum of ice condenser). Both expert judgment and analysis were used in the igniter location selection process. The staff's safety evaluation of the Sequoyah Nuclear Plants' HMSs, which were the lead plants, was published in NUREG-0011, Supplement No. 6, dated December 1982, and provides a discussion of igniter locations. Because of the similarity between the containment arrangements of WBN and Sequoyah Nuclear Plants, NUREG-0011 was used during the review and approval of the WBN HMS to meet the requirements of 10 CFR 50.44.

As discussed in Supplement No. 6 to NUREG-0011, following a degraded core accident, any hydrogen that is produced would be released into the lower compartment. To cover this region, 22 igniters (equally divided between trains) have been provided. Eight of these are distributed on the reactor cavity wall exterior and crane wall interior at an intermediate elevation. Two igniters are located at the lower edge of each of the five SG and pressurizer enclosures, two in the top of the pressurizer enclosure, and another pair above the reactor vessel in the cavity. The two inoperable igniters are located at the lower edge of the No. 4 SG and above the reactor vessel in the cavity. Since there are limited potential hydrogen sources in the reactor cavity and the SG enclosures and significant flows into these enclosures are not expected from the rest of the lower compartment, igniters were not located inside the reactor cavity or in the top of the SG enclosures. Any hydrogen not burned in the lower compartment would be carried up through the ice condenser and into its upper plenum. Mixtures that were nonflammable or not consumed in the lower compartment would tend to become flammable in the ice condenser upper plenum.

Adequate mixing, in conjunction with ignition of lean mixtures, effectively precludes the formation of detonable concentrations. Based on review of the Hanford Engineering Development Laboratory results, the staff concluded that the formation of significant hydrogen concentration gradients in the WBN containment is unlikely if the air return fans survive the accident environment. The operation of the deliberate ignition system near the lower hydrogen flammability limit in conjunction with the mixing by the air return fans ensures that hydrogen concentrations at or below the flammability limit will be maintained throughout containment for the duration of the accident. In this regard, the formation of detonable pockets of hydrogen was precluded.

The WBN Probabilistic Safety Assessment establishes a probability of  $3.6 \times 10^{-7}$  events per reactor-year of a degraded core event based on 72 hours. Accidents that would generate enough hydrogen to exceed the lower flammability limit, assuming a well mixed containment atmosphere, are even more remote.

The staff finds the proposed temporary change to WBN TS 3.6.8, "Hydrogen Mitigation System," as documented in the licensee's letter of April 29, 1998, to be acceptable. The staff's acceptance is based on the following: (1) the capability of the safety-related, redundant air return fans to provide a thoroughly mixed containment atmosphere, (2) the remaining 20 out of 22 igniters in the lower compartment, (3) significant flows from the rest of the lower compartment into the reactor cavity and the No. 4 SG enclosure are not expected, (4) any hydrogen not consumed in the lower compartment would be burned in the upper compartment, and (5) the probability of a degraded core event during a 72 hour period.

### 3.0 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.

### 4.0 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 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 amendment involves no significant hazards consideration, and there has been no public comment on such finding (63 FR 25243, dated May 7, 1998). 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.

## **5.0 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) 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 Contributor: M. Snodderly

Date: June 9, 1998