January 27, 2006

Mr. Karl W. Singer
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 - REQUEST FOR RELAXATION FROM THE FIRST REVISED NRC ORDER EA-03-009, DATED FEBRUARY 20, 2004, DEFERRAL OF NONVISUAL NONDESTRUCTIVE EXAMINATIONS (TAC NO. MC8543)

Dear Mr. Singer:

By letter dated October 4, 2005, Tennessee Valley Authority (the licensee) requested relaxation to defer the nonvisual nondestructive examination (NDE) required under Paragraph IV.C.(5)(b) of the First Revised Nuclear Regulatory Commission (NRC) Order EA-03-009 (Order), dated February 20, 2004, for reactor pressure vessel head penetration nozzles at the Watts Bar Nuclear Plant, Unit 1, until after the February 11, 2008, deadline stated in Paragraph IV.C.(3) for completion of first time nonvisual NDE. Due to the steam generator replacement project scheduled for the Cycle 7 refueling outage during the fall of 2006, the licensee has proposed to perform the nonvisual NDE in accordance with the requirements of Paragraph IV.C.(5)(b) of the Order prior to restarting the facility from the Cycle 8 refueling outage which is expected to commence on or before February 10, 2008.

The NRC staff concludes that the licensee's proposed alternative inspection schedule to meet the Order, provides an acceptable level of quality and safety. Therefore, pursuant to Paragraph IV.F of the Order, the staff authorizes the proposed alternative inspection schedule at the Watts Bar Nuclear Plant, Unit 1.

Our safety evaluation is enclosed.

Sincerely,

/RA by BMozafari for/
Michael L. Marshall, Jr., Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosure: Safety Evaluation

cc: See next page

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WATTS BAR NUCLEAR PLANT

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FIRST REVISED NRC ORDER EA-03-009 RELAXATION REQUEST

DEFERRAL OF NONVISUAL NONDESTRUCTIVE EXAMINATION

FOR REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES

WATTS BAR NUCLEAR PLANT, UNIT 1

TENNESSEE VALLEY AUTHORITY

DOCKET NUMBER 50-390

1.0 INTRODUCTION

The First Revised NRC Order EA-03-009 (Order), issued on February 20, 2004, requires specific examinations of the reactor pressure vessel (RPV) head and vessel head penetration (VHP) nozzles of all pressurized-water reactor plants. Paragraph IV.F of the Order states that requests for relaxation of the Order associated with specific penetration nozzles will be evaluated by the NRC staff using the procedure for evaluating proposed alternatives to the American Society of Mechanical Engineers Code in accordance with Title 10, Code of Federal Regulations Section 50.55a(a)(3). Paragraph IV.F of the Order states that a request for relaxation regarding inspection of specific nozzles shall address the following criteria: (1) the proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety, or (2) compliance with this Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

For Watts Bar Nuclear Plant, Unit 1 (WBN), and similar plants determined to have a low susceptibility to primary water stress corrosion cracking (PWSCC) in accordance with Paragraph IV.C.(3) of the Order, the requirements of Paragraph IV.C.(5)(b) must be completed at least once prior to February 11, 2008, and thereafter, at least every 4 refueling outages or every 7 years, whichever occurs first. The requirements of Paragraph IV.C.(5)(b) of the Order include:

> (b) For each penetration, perform a nonvisual NDE [nondestructive examination] in accordance with either (i), (ii), or (iii):
>
> (i) Ultrasonic testing of the RPV head penetration nozzle volume (i.e., nozzle base material) from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the

ENCLOSURE

nozzle if less than 2 inches [see Figure IV-1]); OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0- inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-2). In addition, an assessment shall be made to determine if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head low-alloy steel.

(ii) Eddy current testing or dye penetrant testing of the entire wetted surface of the J-groove weld and the wetted surface of the RPV head penetration nozzle base material from at least 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches [see Figure IV-3]); OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0- inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-4).

(iii) A combination of (i) and (ii) to cover equivalent volumes, surfaces, and leak paths of the RPV head penetration nozzle base material and J-groove weld as described in (i) and (ii). Substitution of a portion of a volumetric exam on a nozzle with a surface examination may be performed with the following requirements:

1. On nozzle material below the J-groove weld, both the outside diameter and inside diameter surfaces of the nozzle must be examined.

2. On nozzle material above the J-groove weld, surface examination of the inside diameter surface of the nozzle is permitted provided a surface examination of the J-groove weld is also performed.

By letter dated October 4, 2005, Tennessee Valley Authority (TVA, the licensee) requested relaxation to defer the nonvisual NDE required under Paragraph IV.C.(5)(b) of the Order for RPV head penetration nozzles at WBN until after the February 11, 2008, deadline stated in Paragraph IV.C.(3) for completion of first time nonvisual NDE.

2.0 ORDER RELAXATION REQUEST FOR DEFERRAL OF NONVISUAL NDE FOR RPV HEAD PENETRATION NOZZLES

2.1 Order Requirements for Which Relaxation is Requested

Paragraph IV.C.(3) of the Order requires, in part, that inspections of Paragraph IV.C.(5)(b) of the Order be performed at least once prior to February 11, 2008, and thereafter, at least every four refueling outages or every 7 years, whichever occurs first for low susceptibility plants similar to WBN.

The licensee has requested relaxation from Paragraph IV.C.(3) of the Order. The specific relaxation requested is identified below.

2.2 Licensee's Proposed Alternative

The licensee proposes to:

(1) Perform the bare metal visual examination of 100 percent of the RPV head surface as required by Paragraph IV.C.(5)(a) of the Order during the Cycle 7 refueling outage in the fall of 2006. Successive bare metal visual examinations will be scheduled in accordance to the requirements of Paragraph IV.C.(3) of the Order.

(2) Shut down WBN on or before February 10, 2008, for Cycle 8 refueling outage, and perform the nonvisual NDE in accordance with the requirements of Paragraph IV.C.(5)(b) of the Order prior to restart.

2.3 Licensee's Basis for Proposed Alternative

The licensee stated that in response to the revised Order, TVA notified NRC in a March 11, 2004, letter that a firm schedule for completing the nonvisual NDE had yet to be determined, due to the process of planning the replacement of the four Unit 1 steam generators. The licensee also stated that they would submit appropriate schedule relief from the Order requirements if relief was needed. The nonvisual NDE is normally performed during the core-empty period with the head set on a modified head stand. The modified head stand is required to elevate the head in the stored position to allow the inspection tool to be placed under the head. The location of the WBN head stand is in a critical work path for steam generator replacement (SGR) upper containment work scope and will have a significant impact to the project.

The licensee stated that the SGR project will involve a considerable amount of work in the Unit 1 Containment Building. Scheduling the RPV nonvisual NDE during this outage will increase general area dose rates to the supplemental SGR personnel, increase critical path time to the outage, and increase the possibility of damage to the head and associated control rod drive assemblies while on the head stand due to the overhead work associated with the SGR project. The licensee plans to "store" the RPV head on the vessel with the reactor cavity missile shields reinstalled during the SGR project. The nonvisual NDE of the RPV head penetrations cannot be performed during this configuration. As noted in the referenced response letter, WBN is a low susceptibility plant as defined by the Order. WBN will not exceed the NRC-established threshold of low susceptibility category for the current licensed life of the

plant primarily due to the low operating head temperature. The bare metal visual examination of the reactor vessel head surface described in Paragraph IV.C.(5)(a) of the Order was performed at WBN during the Cycle 5 refueling outage in September 2003. No leakage was reported. The inspection results were provided to NRC by letter dated December 10, 2003. As required by Paragraph IV.C.(3) of the Order, this examination must be performed at least every third refueling outage or every 5 years, (i.e., by the WBN Cycle 8 refueling outage); however, the licensee proposes to perform this bare metal visual examination during the Cycle 7 refueling outage scheduled for fall of 2006. Successive bare metal visual examinations will be scheduled in accordance with Paragraph IV.C.(3).

The licensee plans to shut down WBN on or before February 10, 2008. The nonvisual NDE of the closure head will be performed in accordance with Paragraph IV.C.(5)(b) of the Order prior to restarting the unit. Based on the information discussed above and the proposed action of placing the unit in a safe shutdown mode commencing February 11, 2008, an acceptable level of quality and safety is achieved.

3.0 STAFF EVALUATION

The NRC staff's review of this request was based on criterion (1) of Paragraph IV.F of the Order, which states that the proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety.

The safety issues that are addressed by the Order are degradation (corrosion) of the low-alloy steel RPV head, reactor coolant pressure boundary integrity and ejection of the VHP nozzle due to circumferential cracking of the nozzle above the J-groove weld. Based on the information provided by the licensee, regarding the low operating temperature of the plant, WBN will not progress into the moderate or high susceptibility category for PWSCC within the design life of the plant. Because of the low operating temperature of the plant, there is reasonable assurance that the safety issues described above will not occur prior to February 10, 2008.

In its letter dated October 4, 2005, the licensee committed to perform the bare metal visual examination of 100 percent of the RPV head surface as required by Paragraph IV.C.(5)(a) of the Order during the Cycle 7 refueling outage in the fall of 2006. The licensee further stated that the successive bare metal visual examinations will be scheduled in accordance with the requirements of Paragraph IV.C.(3) of the Order. At WBN, the first bare metal visual examination of the reactor vessel head surface was performed during the Cycle 5 refueling outage in September 2003 and no leakage was reported.

As required by Paragraph IV.C.(3) of the Order, this examination must be performed at least every third refueling outage or every 5 years, (i.e., by the WBN Cycle 8 refueling outage). However, the licensee proposes to perform the second bare metal visual examination during the Cycle 7 refueling outage scheduled for fall of 2006. The staff notes that experience with this method of examination in the fleet has been proven effective in detecting small leaks from the J-groove weld and the nozzle pressure boundary by identifying boron deposits on the reactor pressure vessel head. The licensee's proposed reinspection schedule for the bare metal visual examination at WBN meets the Order requirements, and therefore, is acceptable to the staff.

In its submittal dated October 4, 2005, the licensee also committed to perform the nonvisual NDE in accordance with the requirements of Paragraph IV.C.(5)(b) of the Order, prior to restarting the unit from the Cycle 8 refueling outage which is expected to commence on or before February 10, 2008. The Order requires that the nonvisual NDE must be completed for the first time by February 11, 2008. The purpose of the inspection is to assure the structural integrity of the reactor vessel head. The staff finds that the licensee's commitment to perform the nonvisual NDE prior to the restart of WBN meets the intent of the Order.

Based on the above discussion, the NRC staff finds that the proposed alternatives to perform the bare metal visual examination during the Cycle 7 refueling outage and to shut down WBN on or before February 10, 2008, until the nonvisual NDE is performed, provide a reasonable assurance of the structural integrity of the reactor vessel head, and therefore, are acceptable to the NRC staff.

4.0 CONCLUSION

The NRC staff concludes that the licensee's proposed alternative inspection schedule of WBN to meet the Order provides an acceptable level of quality and safety. Therefore, pursuant to Paragraph IV. F. of the Order, the staff authorizes the proposed alternative inspection schedule at WBN.

Principal Contributor: T. Steingass

Dated: January 27, 2006