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Mike Skaggs
Site Vice President, Watts Bar Nuclear Plant

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10 CFR 2.202

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Gentlemen:

In the Matter of	)	Docket No. 50-390
Tennessee Valley Authority	)	

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - FIRST REVISED NRC ORDER EA-03-009 ESTABLISHING INTERIM INSPECTION REQUIREMENTS FOR REACTOR PRESSURE VESSEL HEADS AT PRESSURIZED WATER REACTORS (PWRs) – NONVISUAL NONDESTRUCTIVE EXAMINATION INSPECTION RESULTS

References:

1) TVA letter to NRC dated October 4, 2005, "Watts Bar Nuclear Plant (WBN) Unit 1 – NRC First Revised Order EA-03-009 Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors – Request for Relief"

2) NRC letter to TVA dated January 27, 2006, "Watts Bar Nuclear Plant, Unit 1 – Request for Relaxation from the First Revised NRC Order EA-03-009, Dated February 20, 2004, Deferral of Non-visual Nondestructive Examinations (TAC No. MC8543)"

3) TVA letter to NRC dated March 3, 2008, "Watts Bar Nuclear Plant (WBN) Unit 1 – Request for Relaxation from Requirements of First Revised NRC Order EA-03-009"

4) NRC letter to TVA dated March 12, 2008, "Watts Bar Nuclear Plant (WBN) Unit 1 – Relaxation from Requirements of First Revised NRC Order EA-03-009 (TAC No. MD8204)"

5) TVA letter to NRC dated December 10, 2003, "Watts Bar Nuclear Plant (WBN) Unit 1 – NRC Order EA-03-009 – Interim Inspection Requirements for Reactor Pressure Vessel Heads (TAC No. MB7667) and Bulletin 2003-02 – Leakage from Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity (TAC No. MC0576)"

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6) TVA letter to NRC dated January 26, 2007, "Watts Bar Nuclear Plant (WBN) Unit 1 – First Revised NRC Order EA-03-009 Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors (PWRs) – Bare Metal Inspection Results"

7) TVA Letter to NRC dated December 6, 2006, "Sequoyah Nuclear Plant (SQN) Units 1 and 2 and Watts Bar Nuclear Plant (WBN) Unit 1 – American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI – Reactor Pressure Vessel Head (RPVH) Penetrating Tube Remote Inner-Diameter Temper Bead (IDTB) Repair – Generic Request for Relief G-RR-2"

8) TVA Letter to NRC dated December 14, 2007, "Sequoyah Nuclear Plant (SQN) Units 1 and 2 and Watts Bar Nuclear Plant (WBN) Unit 1 – American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI – Reactor Pressure Vessel Head (RPVH) Penetrating Tube Remote Inner-Diameter Temper Bead (IDTB) Repair – Generic Request for Relief G-RR-2 – Response to Request for Additional Information (RAI)

9) NRC Letter to TVA dated February 8, 2008, "Watts Bar Nuclear Plant, Unit 1 – Safety Evaluation of Relief Request G-RR-2, Proposed Alternative to American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Reactor Pressure Vessel Head Penetration Tube Remote Inner-Diameter Temper Bead Repair (TAC NO. MD3766).

This letter provides the WBN Unit 1 60-day response to the reporting requirements listed in Section IV, Paragraph E of the First Revised NRC Order EA-03-009 dated February 20, 2004, for the non-visual nondestructive examination (NDE) of the reactor pressure vessel head (RPVH) closure as required by Section IV.C.(5)(b) of the Order. This inspection was deferred with NRC approval until after the WBN Cycle 8 refueling outage due to steam generator replacement project (see Reference 1 and 2). In addition, TVA requested and received relaxation, in accordance with Section IV.F of the Order, regarding inspection of a specific nozzle (see Reference 3 and 4). The NDE inspections were completed in March 2008.

By letter dated December 6, 2006 as supplemented by letter dated December 14, 2007, (reference 7 and 8), TVA requested NRC's approval for the use of an alternative repair/replacement methodology for the RPVH penetration nozzles and J-groove welds for Watts Bar Unit 1 in the event that in-service examination results were determined unacceptable. Pursuant to 10 CFR 50.55a(g)(6)(i), the NRC granted TVA Relief Request G-RR-2 on February 8, 2008 (reference 9). Subsequent to this approval, TVA completed

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the required volumetric examination of the RPVH as required by Section IV.C.(5)(b) of the Order during the WBN Cycle 8 refueling outage. Because no recordable degradations requiring repairs or replacement were detected during the performance of these examinations, TVA did not implement Relief Request G-RR-2 for WBN Unit 1.

WBN Unit 1 RPVH has a low susceptibility to primary water stress corrosion cracking as defined by Section IV, paragraph B of the Order. Based on the results of the RPVH inspections which included both bare metal visual examinations (see Reference 5 and 6) and NDE testing by AREVA, TVA confirmed that there are no indications of RPVH degradation or primary water stress corrosion cracking of the weldments associated with the RPVH penetration nozzles for Unit 1.

Enclosure 1 provides the AREVA NDE Report Summary.

There are no regulatory commitments associated with this submittal. If you have any questions concerning this matter, please call me at (423) 365-1824.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 27th day of May 2008.

Sincerely,

Michael J. Lorek (Acting for
M. D. Skaggs Site Vice President)

Enclosure
cc: See Page 4

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Enclosure
cc (Enclosure):
NRC Resident Inspector
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ATTN: Patrick D. Milano, Project Manager
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ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY (TVA)
WATTS BAR NUCLEAR PLANT (WBN0
UNIT 1

AREVA REPORT
NUMBER 51-9073686-001

AREVA

ENGINEERING INFORMATION RECORD

Document Identifier 51 - 9073686 - 001

Title **Watts Bar Unit 1, Cycle 8 - Reactor Head Inspection Report**

PREPARED BY:		REVIEWED BY:	
Name	MG Hacker	Name	Scott R. Bowling
Signature	M. G. Hacker	Signature	
Date	5-6-08	Date	5-6-08

Technical Manager Statement: Initials THD

Reviewer is Independent.

Remarks:

This document contains the description, results, and associated documentation of the NDE examinations performed on the Watts Bar, Unit 1 RPV closure head during the Cycle 8 outage. The examinations included ultrasonic examination of 78 CRDM penetrations, 1 vent line, and 4 Auxiliary Head Adapter (AHA) dissimilar metal welds. No evidence of cracking or leak path was detected on any of the CRDM nozzles. No evidence of cracking was detected in the vent line nozzle or any of the AHA dissimilar metal welds. The vent line J-groove weld and end of nozzle was also examined using liquid penetrant techniques. No indications were reported on the Ventline J-groove weld and nozzle end.

Report Contents

Any illegible portions of the inserted pictures are not intended to be used for data interpretation and are therefore not essential nor required to be legible for the purposes of this summary.

AREVA

TVA

TVA

Watts Bar, Unit 1
Cycle 8

RPVH Penetration
Examination Report
Summary

AREVA

Examination Summary

Introduction

During the Watts Bar, Unit 1, 2008 Cycle 8 refueling outage, AREVA NP performed a comprehensive examination of the reactor vessel (RPV) head penetrations to meet the First Revised NRC Order EA-03-009 issued February 20, 2004. AREVA NP performed remote ultrasonic (UT) examinations of 78 control rod drive mechanism (CRDM) penetrations and 1 vent line penetration. A liquid penetrant (PT) examination was also performed on the vent line J-groove weld surface. Each penetration was examined from the under-side of the reactor vessel head using "Bottom-Up" and "Blade" UT tools delivered by a positioning manipulator (NUMAN). Data acquisition and data analysis was performed remotely from outside the radiation controlled area using the ZETEC Ultravision software.

In addition, 4 Auxiliary Head Adapter (AHA) dissimilar metal welds were ultrasonically examined to ASME Section XI, Appendix VIII, requirements. These welds are not applicable to the NRC Order. These welds were examined remotely from the ID from the under-side of the reactor vessel head using a "Bottom-Up" rotating UT probe delivered by a positioning manipulator (NUMAN). Data acquisition and data analysis was performed remotely from outside the radiation controlled area using the AREVA NP ACCUSONEX software.

Results

No crack indications or UT leak path signals were detected in the 78 CRDM penetrations. No crack indications were detected in the vent line penetration with either the UT or PT examinations. No crack indications were detected in the 4 AHA dissimilar metal welds.

Weld fabrication indications were observed on nearly all CRDM nozzles and were individually recorded on data sheets when the indication extended into the tube wall by more than 10% of the tube wall thickness. These indications are typical for this weld configuration and none are significant or connected to the wetted surface. In addition, tube wall inclusions were observed in several penetrations and were separately recorded on the indication data sheet when they were clearly discernable in the data. Other areas of "noise bands" were noted in some of the penetrations and were noted in the remarks section of the data sheet for future reference. These areas are attributed to regions of the tube that may contain small pores that provide some reflectivity. These "noise bands" and tube wall inclusions have been observed on other heads manufactured by Rotterdam and are typical for this manufacturer.

CRDM Penetration Examinations

CRDM penetrations 1 through 73 were examined with the blade probe in accordance with AREVA NP NDE examination procedure 54-ISI-603-003, "Automated Ultrasonic Examination of RPV Closure Head Penetrations Containing Thermal Sleeves". CRDM penetrations 74 through 78 were examined with the rotating probe in accordance with AREVA NP NDE examination procedure 54-ISI-604-004, "Automated Ultrasonic Examination of Open Tube RPV Closure Head Penetrations" with SDCN 30-9063103-000 and SDCN 30-9035469-002.

The application of the techniques used for these examinations are described in more detail in the "Inspection Plan" included in Section A, Tab 2 of this report. The procedures are included in Section C of this report. The UT examination data sheets are included in Section A, Tab 4 of this report.

The coverage obtained for all CRDM nozzles except nozzle 74 meets the requirements of the First Revised NRC Order EA-03-009 issued February 20, 2004. Consistent with the NRC Order, TVA has performed an analysis to determine the distance below the J-Groove weld where the operating stresses decay to 20ksi tension. The minimum required examination zone below the lowest point of the J-Groove weld is the greater of the 20ksi boundary value below the weld or 1". CRDM penetrations 1-78 were scanned starting from the taper transition point at the bottom of each nozzle up to at least two inches above the highest point of the J-Groove weld. An ID chamfer on the end of each CRDM nozzle precludes coverage to the very end of the nozzle. Coverage for all nozzles except nozzle 74 was obtained over a distance that includes the greater of the 20ksi boundary value below the weld or 1" below the lowest point of the J-Groove weld up to at least 2 inches above the highest point of the J-Groove weld. A listing of the coverage obtained for each nozzle above and below the weld is provided in the "Examination Summary Table" included in Section A, Tab 3 of this report.

The distance between the toe of the J-Groove weld and the taper to cylinder transition at the lowest point of the J-Groove weld on nozzle 74 precludes obtaining the required coverage value of 1" below the lowest point of the J-Groove weld. Nozzle 74 coverage was limited to 0.91" due to the proximity of the J-groove weld to the ID chamfer. This information was provided to TVA personnel at the time of discovery for disposition.

Scanning was performed in an up and down fashion (comb pattern) parallel to the penetration axis. Indexing of the probe-head was performed in the circumferential direction. The positive scan direction was defined to be upward, and positive index was defined to be counter-clockwise looking up from the bottom of the vessel head. The circumferential scan distance covered from 0 degrees to positive 370 degrees, yielding a 10-degree overlap. De-mineralized water was used as the coupling agent between the transducer face and the penetration surface.

The blade probe uses a 5 MHz, circumferentially oriented, time of flight diffraction (TOFD) beam in the tube for examination. The rotating probe-head houses four ultrasonic transducers as outlined in Table 1 below. Both forward scatter, time of flight diffraction (TOFD), and backward scatter techniques are utilized. The 30°L and 45°LE transducers are configured in the forward scatter configuration, and the 60°S transducers in the backward scatter configuration. Each of these transducers provides detection and characterization information for (ID/OD) connected axial, circumferential, and off-axis flaws contained within the penetration wall.

Table 1 - CRDM Rotating Probe Configuration			
Angle/ Mode	**Freq (MHz)**	**Beam Dir.**	**Application**
0° L	5.0	N/A	Flaw detection, length sizing, and weld profiling
30° L - TOFD	5.0	Axial	Circumferential, axial, and off-axis flaw detection and characterization
60° S - Backscatter	2.25	Axial Down	Circumferential and off-axis flaw detection and characterization
45° LE - TOFD	5.0	Circ.	Axial, circumferential and off-axis flaw detection and characterization

Vent Line Penetration Examination

The Vent Line was examined with both liquid penetrant (PT) and ultrasonic testing (UT) to satisfy the First Revised NRC Order EA-03-009 requirements. The vent line penetration tube was examined with UT using the vent line probe in accordance with AREVA NP NDE examination procedure 54-ISI-605-04, "Automated Ultrasonic Examination of RPV Closure Head Small Bore Penetrations". The procedure is included in Section C of this report. The UT examination data sheets are included in Section A, Tab 4 of this report. No flaws were detected in the vent line nozzle material.

Scanning was performed in an up and down fashion (comb pattern) parallel to the penetration axis. Indexing of the probe-head was performed in the circumferential direction. The positive scan direction was defined to be upward, and positive index was defined to be counter-clockwise looking up from the bottom of the vessel head. The circumferential scan distance covered from 0 degrees to positive 370 degrees, yielding a 10-degree overlap. De-mineralized water was used as the coupling agent between the transducer face and the penetration surface.

The vent line J-groove weld surface was examined with the PT method in accordance with AREVA NP examination procedure 54-ISI-200-08, "Color Contrast Solvent Removable Liquid Penetrant Examination of Components". No indications were detected during this examination. The PT examination data sheet is included in Section A, Tab 6 of this report.

The Vent Line UT probe-head houses five separate transducers as shown below in Table 2. These transducers provide detection information for (ID/OD) connected axial and circumferential flaws contained within the penetration wall.

Table 2 - Vent Line Penetration Probe Configuration			
Angle/ Mode	**Freq. (MHz)**	**Beam Dir.**	**Application**
0° L	5.0	N/A	Weld profiling
45° S Backscatter	5.0	Circ. CW	Axial flaw detection
45° S Backscatter	5.0	Circ. CCW	Axial flaw detection
70° S Backscatter	5.0	Axial Up	Circumferential flaw detection
70° S Backscatter	5.0	Axial Down	Circumferential flaw detection

AHA Dissimilar Metal Weld Examinations

The AHA dissimilar metal welds were examined with a rotating probe in accordance with AREVA NP NDE examination procedure 54-ISI-824-000, "ID Automated Ultrasonic Examination of Small Bore Dissimilar Metal Welds". The AHA UT probe-head houses four separate transducers as shown below in Table 3. These transducers provide detection information for ID surface connected axial and circumferential flaws. No flaws were detected during the examination.

Scanning was performed in the circumferential direction using a raster pattern perpendicular to the penetration axis. Indexing of the probe-head was performed in the axial direction. The positive scan direction was defined to be counter-clockwise looking up from the bottom of the vessel head and positive index was defined to be upward. The circumferential scan distance covered from 0 degrees to positive 370 degrees, yielding a 10-degree overlap. De-mineralized water was used as the coupling agent between the transducer face and the penetration surface.

Table 3 – AHA Dissimilar Metal Weld Probe Configuration			
Angle/ Mode	**Freq. (MHz)**	**Beam Dir.**	**Application**
80° L	2.0	Up	Circ. flaw detection
80° L	2.0	Down	Circ. flaw detection
80° L TOFD	2.25	Circ.	Axial flaw detection
60° L	2.25	Circ. CCW	Supplemental Axial flaw Detection/Sizing