February 6, 2002

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

SUBJECT: EVALUATION OF INSERVICE INSPECTION PROGRAM RELIEF REQUEST NOS. 1-ISI-07 THROUGH 1-ISI-12 FOR WATTS BAR NUCLEAR PLANT, UNIT 1 (TAC NO. MB1274)

Dear Mr. Scalice:

Tennessee Valley Authority's (TVA's) letter of February 21, 2001, requested approval of six relief requests for Inservice Inspection (ISI) Program components examined during the Cycle 3 refueling outage at the Watts Bar nuclear plant, because the full inspection coverage required by American Society of Mechanical Engineers (ASME) Code, Section XI, could not be achieved. Additional information was provided in a letter dated August 9, 2001.

The U.S. Nuclear Regulatory Commission staff, with technical assistance from its contractor, Brookhaven National Laboratory, has reviewed and evaluated the relief requests. Based on the information provided by Tennessee Valley Authority (TVA), the staff concludes that the requests for relief are acceptable.

Therefore, TVA's Relief Request Nos. 1-ISI-07 through 1-ISI-12 are granted pursuant to Title 10, *Code of Federal Regulations* (10 CFR), Section 50.55a(g)(6)(i), for the first 10-year ISI interval on the basis that the full inspections required by the Code are impractical and the examinations performed provide reasonable assurance of structural integrity of the subject welds.

A copy of our safety evaluation is enclosed.

Sincerely,

/RA/
Richard P. Correia, Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosure: Safety Evaluation

cc w/enclosure: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FIRST 10-YEAR INTERVAL INSERVICE INSPECTION

REQUEST FOR RELIEF NOS. 1-ISI-07 THROUGH 1-ISI-12

WATTS BAR NUCLEAR PLANT, UNIT 1

TENNESSEE VALLEY AUTHORITY

DOCKET NUMBER 50-390

1.0 INTRODUCTION

Inservice inspection of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable addenda as required by 10 CFR 50.55a(g), except where specific relief has been granted by the U.S. Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). Title 10, *Code of Federal Regulations (*10 CFR), Section 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The Code of record for the Watts Bar Nuclear Plant, Unit 1, first 10-year ISI interval is the 1989 Edition of the ASME Code, Section XI.

2.0 EVALUATION

The Materials and Chemical Engineering Branch, with technical assistance from Brookhaven National Laboratory (BNL), has reviewed the information concerning ISI program Request for Relief Nos. 1-ISI-07 through 1-ISI-12 for the first 10-year interval for Watts Bar Nuclear Plant, Unit 1, provided in a Tennessee Valley Authority (the licensee) letter dated February 21, 2001. The licensee provided additional information in its letter dated August 9, 2001.

The staff adopts the evaluations and recommendations for granting relief from the ASME Code, Section XI, requirements, contained in the Technical Letter Report (TLR), included as Attachment 2, prepared by BNL. Attachment 1 lists each portion of the relief request and the status of approval.

For Request for Relief No. 1-ISI-07, the licensee requested relief from surface examination coverage of essentially 100% of the four integrally welded lug attachments to the centrifugal charging pump (1A-A) casing due to limited access resulting from component design configuration. Imposition of this requirement would create a significant burden on the licensee as the subject component would have to be redesigned in order to perform the ASME Code, Section XI, required examinations. The staff determined that surface examination of the subject integral attachment welds is impractical to perform to the extent required by the ASME Code, Section XI. The licensee obtained 80% of the surface examination of the weld area and adjacent ½ inch of the pump housing past the toe of the weld. The licensee's surface examination performed provides reasonable assurance of the structural integrity of the subject weld.

For Request for Relief No. 1-ISI-08, the licensee requested relief from performing the required volumetric examination on essentially 100% of the lower one-third volume of the Steam Generator 1 nozzle-to-safe end butt welds (RCF-D1-2-SE and RCF-F1-1-SE). The staff determined that complete volumetric examination of the subject welds was limited by component geometry and material properties. Imposition of this requirement would create a significant burden on the licensee as the subject component would have to be redesigned in order to perform the ASME Code, Section XI, required examinations. The licensee considered radiographic examination of the subject welds. However, it was determined to be impractical due to radiation exposure and lack of access from the inside diameter of the nozzles. Therefore, the ASME Code, Section XI, volumetric coverage requirements are impractical for the subject welds. The licensee obtained 61% and 65% of the ASME Code, Section XI, volumetric examination of the subject welds. The partial volumetric examinations obtained by the licensee provides reasonable assurance of structural integrity of the steam generator nozzle-to-safe end welds.

For Request for Relief No. 1-ISI-09, the licensee requested relief from performing the required volumetric examination on essentially 100% of the full volume of the residual heat removal heat exchanger shell-to-flange weld. The staff determined that complete examination coverage is limited by physical interferences from the permanently welded pipe-to-vessel reinforcing plates. Imposition of this requirement would create a significant burden on the licensee as the subject component would have to be redesigned in order to perform the ASME Code, Section XI, required examinations. Therefore, the ASME Code, Section XI, coverage requirements are impractical. The licensee obtained 77.4% of the ASME Code, Section XI, volumetric examination of the subject weld. The partial volumetric examinations obtained by the licensee provides reasonable assurance of structural integrity of the subject weld.

For Request for Relief No. 1-ISI-10, the licensee requested relief from performing the required surface examination on essentially 100% of the examination surface of the Boron Injection Tank integrally welded attachments. The staff determined that the ASME Code, Section XI, surface examination is impractical due to restricted access caused by the design configuration of the integrally welded attachments and the legs attached to the tank. Imposition of this requirement would create a burden on the licensee as the subject component would have to be redesigned in order to perform the ASME Code, Section XI, required examinations. The

licensee obtained 78% of the ASME Code, Section XI, surface examination of each of the subject welds. The partial surface examinations obtained by the licensee provides reasonable assurance of structural integrity of the subject welds.

For Request for Relief No. 1-ISI-11, the licensee requested relief from performing the required volumetric examination on essentially 100% of the full volume of the Boron Injection Tank shell-to-head circumferential welds. The staff determined that complete examination coverage is limited due to the taper of the shell. Imposition of this requirement would create a significant burden on the licensee as the subject component would have to be redesigned in order to perform the ASME Code, Section XI, required examinations. Therefore, the ASME Code, Section XI, volumetric examinations are impractical. The licensee obtained 60% and 61% volumetric coverage for welds BIT-2 and BIT-3, respectively. The licensee will also be performing a VT-2 visual examination during system leakage tests. The staff determined that performance of the volumetric examinations and the VT-2 visual examination during the system leakage tests provides reasonable assurance of structural integrity of the subject welds.

For Request for Relief No. 1-ISI-12 the licensee requested relief from performing the required ASME Code, Section XI, volumetric examination on essentially 100% of the lower one-third volume of the Boron Injection Tank nozzle-to-head welds. The staff determined that complete volumetric examination of the subject welds was limited by the design configuration of the shell-to-flange welds. Imposition of this requirement would create a significant burden on the licensee as the subject components would have to be redesigned in order to perform the ASME Code, Section XI, required examinations. Therefore, the ASME Code, Section XI, volumetric examinations are impractical. The licensee obtained 80% volumetric and 100% surface coverage for the Boron Injection Tank Nozzle-to-Head welds (BIT-1 and BIT-4). The staff determined that the volumetric examinations performed by the licensee provides reasonable assurance of structural integrity of the subject welds.

3.0 CONCLUSION

The staff evaluated the licensee's submittal and concluded that certain inservice examinations cannot be performed to the extent required by the ASME Code, Section XI, at the Watts Bar Nuclear Plant, Unit 1. For Request for Relief Nos. 1-ISI-07 through 1-ISI-12 the staff concludes that the Code requirements are impractical and the examinations performed provide reasonable assurance of structural integrity of the subject welds. Therefore, Request for Relief Nos. 1-ISI-07 through 1-ISI-12 are granted pursuant to 10 CFR 50.55a(g)(6)(i) for the first 10-year ISI interval. The staff has determined that this grant of relief is authorized by law and will not endanger life or property, or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Attachments:
1. Table - Summary of Relief Requests
2. BNL Technical Letter Report

Principal Contributor: T. McClellan, NRR

Date: February 6, 2002

WATTS BAR NUCLEAR PLANT (WBN) - UNIT 1
First 10-Year ISI Interval

SUMMARY OF RELIEF REQUESTS

Relief Request Number	TLR Sec.	System or Component	Exam Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Proposed Alternative	Relief Request Status
1-ISI-07	2.1	Charging Pump	C-C	C3.30	Integrally welded lugs	Surface examination	Performed on accessible areas, Code Case N-509	Granted 10 CFR 50.55a(g)(6)(i)
1-ISI-08	2.2	Steam Generator	B-F	B5.70	Nozzle-to-safe end butt welds	Volumetric and surface examinations	Performed on accessible areas for volumetric	Granted 10 CFR 50.55a(g)(6)(i)
1-ISI-09	2.3	RHR Heat Exchnager	C-A	C1.10	Shell-to-flange weld	Volumetric examination	Performed on accessible areas	Granted 10 CFR 50.55a(g)(6)(i)
1-ISI-10	2.4	Boron Injection Tank Support	C-C	C3.10	Integrally welded attachments	Surface examination	Performed on accessible areas, Code Case N-509	Granted 10 CFR 50.55a(g)(6)(i)
1-ISI-11	2.5	Boron Injection Tank	C-A	C1.20	Shell-to-head circumferential welds	Volumetric examination	Performed on accessible areas	Granted 10 CFR 50.55a(g)(6)(i)
1-ISI-12	2.6	Boron Injection Tank	C-B	C2.21	Nozzle-to-head welds	Volumetric and surface examinations	Performed on accessible areas for volumetric	Granted 10 CFR 50.55a(g)(6)(i)

ATTACHMENT 1

TECHNICAL LETTER REPORT
FIRST 10-YEAR INSERVICE INSPECTION INTERVAL
REQUEST FOR RELIEF NOS. 1-ISI-07 THROUGH 1-ISI-12
TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT, UNIT 1
DOCKET NUMBER: 50-390

1. SCOPE

By letter dated February 21, 2001, the licensee, Tennessee Valley Authority (TVA), submitted six requests for relief from the requirements of the ASME Code, Section XI, for the Watts Bar Nuclear Plant (WBN), Unit 1. These relief requests are for the first 10-year inservice inspection (ISI) interval. Brookhaven National Laboratory (BNL) reviewed the information submitted by the licensee and the evaluation of the subject requests for relief are discussed in the following section.

2. EVALUATION

The information provided by TVA in support of the six requests for relief from ASME Code requirements and the licensee responses to the BNL staff's request for additional information (RAI) in a letter dated August 9, 2001, has been evaluated and the bases for disposition are documented below. The Code of Record for the Watts Bar Nuclear Plant (WBN), Unit 1, first 10-year ISI interval, which began on May 27, 1996, is the 1989 Edition of Section XI of the ASME Boiler and Pressure Vessel Code.

2.1 Request for Relief No. 1-ISI-07, for Four Integrally Welded Lug Attachments of the Weld CCPH-1A-A-1A to Centrifugal Charging Pump 1A-A casing, Examination Category C-C, Item Number C3.30, Code Case N-509.

Note: The licensee is using Code Case N-509 (11-25-92), "Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments," in lieu of the requirements of the Code for the examination of Class 1, 2, and 3 integrally welded attachments. Code Case N-509 has been approved conditionally for general use in Regulatory Guide 1.147, Rev. 12. The condition stated in the Regulatory Guide is that a minimum 10% sample of integrally welded attachments for each item in each code class per interval should be examined.

Code Requirement: ASME Code, Section XI, Table 2500-1, Examination Category C-C, Item Number C3.30 requires surface examination coverage of essentially 100% of the integrally welded attachments (i.e., identifier CCPH-1A-A-IA in ISI Drawing ISI-0118-C-01) to the centrifugal charging pump casing, as defined in Figure IWC-2500-5.

Licensee's Code Relief Request: Pursuant to 10 CFR 50.55a(g)(5)(iii), for the first inspection interval the licensee requested relief from surface examination coverage of essentially 100% of the four integrally welded lug attachments to the centrifugal charging pump (1A-A) casing due to limited access resulting from component design configuration.

Licensee's Basis for Requesting Relief (as stated):
"The design configuration of the integrally welded attachments precludes surface examination of essentially 100% of the required examination area. Reference Examination Report R-0569 (Attachment 3) for location and sketch of inaccessible area. In order to examine the welds in accordance with the code requirement, the centrifugal charging pump would require extensive redesign and modification to allow access to the bottom side of the attachment lugs. Connecting piping would have to be disconnected and the pump disassembled and lifted to allow access to the remaining 16% examination area. The weld joint detail consists of a full penetration weld with fillet weld reinforcement. The attachment is welded all around with a fillet weld. The bottom side of the attachment is inaccessible due to a support which bolts the pump to the supporting frame. The total surface examination coverage for integral attachment welds CCPH-1A-A-1A was approximately 84% of the required code coverage. Other NDE techniques were considered; but, due to the location of the inaccessible area, the same limitations would be encountered."

"Performing a surface examination of essentially 100% of the required area of integrally welded attachments CCPH-1A-A-1A would be impractical. In addition, it is impractical to perform other NDE examinations. The maximum extent practical surface examination of the weld area and adjacent metal of the subject weld provides reasonable assurance of an acceptable level of quality and safety. Significant degradation, if present, would have been detected during the surface examination that was performed on the subject integrally welded attachments. As a result, assurance of structural integrity for the integrally welded attachments is provided by the examination that was performed."

Note: Based on the RAI responses to Question 1(b) dated August 9, 2001, the licensee further reviewed the four sketches in Enclosure 1, Attachment 3 of the February 21, 2001 request for relief and stated "... The weld area receiving the penetrant testing (PT) examination should be indicated as 100.75-inches and not the 107.25-inches as indicated on Report R-0569. Based on this review the actual coverage achieved should be shown as approximately 80%, and not the 84% as indicated in the February 21, 2001 submittal.

Licensee's Proposed Alternative Examination (as stated):
"A liquid penetrant examination was performed on accessible areas to the extent practical given the physical limitations of the subject integrally welded attachments."

Evaluation: The ASME Code, Section XI requires 100% surface examination of the subject integrally welded attachments. The BNL staff determined from reviewing the sketches, photographs and examination reports that complete examination coverage is impractical due to restricted access caused by the design configuration of the pump. To meet the ASME Code, Section XI requirements, the connecting inlet/outlet piping would have to be disconnected, and the pump would have to be uncoupled from the motor and lifted off the pump support to allow access to the remaining examination area. Therefore, surface examination of the subject integral attachment welds is impractical to perform to the extent required by the ASME Code, Section XI. A visual examination of the remaining examination area is also impractical because of the configuration of the pump. Imposition of the Code requirement would create a significant burden on

the licensee as the subject component would have to be redesigned in order to perform the ASME Code, Section XI required examinations.

The licensee has completed 80% of the ASME Code, Section XI-required liquid penetrant examination including the adjacent ½ inch of metal of the pump housing past the toe of the weld. The BNL staff determined that based on the surface coverage obtained, existing patterns of degradation, if present, would have been detected. It was determined that the licensee's surface examination performed provides reasonable assurance of structural integrity of the subject integral attachment welds. Therefore, the BNL staff recommends that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

2.2 Request for Relief No. 1-ISI-08, for Two Nozzle-to-Safe End Butt Welds of Steam Generator 1, Examination Category B-F, Item Number B5.70.

Code Requirement: ASME Code, Section XI, Examination Category B-F, Item Number B5.70 requires both volumetric and surface examination of 100% of the pressure retaining dissimilar metal welds of the two nozzle-to-safe end butt welds of Steam Generator 1, as defined by Figure IWB-2500-8(c).

Licensee's Code Relief Request: Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from performing the required volumetric examination on essentially 100% of the lower one-third volume of the steam generator 1 nozzle-to-safe end butt welds (RCF-D1-2-SE and RCF-F1-1-SE).

Licensee's Basis for Requesting Relief (as stated):
"The design configuration of the steam generator nozzles and the CF8A piping material precludes an ultrasonic examination of the required volume for the nozzle-to-safe end butt welds. The design configuration and piping material limits ultrasonic examination of the code required examination volume to approximately 61% on weld RCF-F1-1-SE (cold leg nozzle) and 65% on weld RCF-D1-2-SE (hot leg nozzle)."

"The geometric configuration of the steam generator hemispherical chamber and nozzle and piping material precludes ultrasonic examination of essentially 100% of the required examination volume. The nozzles are integrally cast with the hemispherical chamber as shown on the Proprietary Westinghouse drawings, EDSK-351101B, EDSK-351097B, and EDSK-351098B which were provided by TVA's letter to NRC dated August 31, 1999 concerning Request for Relief, 1-ISI-5, for WBN. The hemispherical chamber is a SA-216, Gr. WCC casting, clad with austenitic stainless steel. The nozzles have buttered 308L safe ends. The main loop reactor coolant piping connections to the nozzle safe end are static cast SA-351, CF8A elbows. The geometric configuration of the steam generator side of the weld joint prevents an ultrasonic scan from the nozzle side and piping materials prevents two-directional coverage from the pipe side, thus precluding full volume examination. A representative of the achievable examination volume for the nozzle-to-safe end welds is depicted on each of the ultrasonic examination reports (Attachment 3)."

"ASME Section XI requires that the examination volume C-D-E-F as depicted on Figure IWB-2500-8(c) be examined by four scan directions, two normal to the weld and two parallel to the weld. Due to the anisotropic course [sic] grain structure of cast stainless

CF8A materials, the examination was limited to the ½ vee technique using refracted longitudinal wave search units with a beam angle of 45 degrees. All welds received 100% one direction coverage from the elbow side with the sound beam directed toward the steam generator. No scans were performed from the steam generator side due to the nozzle taper interference, therefore, 0% coverage was obtained from this direction. Scans parallel to the weld were performed to the extent that loss of search unit contact occurred on the steam generator side of the weld. All welds were previously conditioned during preservice inspection to maximum search unit coupling and provide access to the maximum extent precluding the nozzle configuration. Based on the extent of coverage obtained, it is reasonable to assure that flaws originating from the inner diameter would be detected to the degree comparable with industry standards."

"WCAP-13670, "Handbook on Flaw Evaluation For Sequoyah Units 1 and 2 Primary Coolant System Piping," dated November 1993, and authored by W. H. Bamford, D. E. Prager, R. Brice-Nash, states that Westinghouse plants have no history of pipe cracking failure in the reactor coolant primary loop with exception of Inconel welds. For stress corrosion cracking (SCC) to occur, the following three conditions must exist simultaneously: high tensile stresses, a susceptible material (these welds contain no Inconel), and a corrosive environment. The potential for SCC is minimized in Westinghouse pressurized water reactors by material selection and prevention of a corrosive environment."

"Radiographic examination of the nozzle-to-safe end weld as an alternative volumetric examination method was also determined to be impractical due to radiation exposure and lack of access from the inside diameter of the nozzles. During refueling outages, access to the steam generator head is provided through the primary manway to perform steam generator tube eddy current testing. Nozzle dams are inserted in the hot and cold legs to allow reactor coolant water to be raised within the hot and cold legs and the reactor vessel above the manway elevation while performing the eddy current testing. However, insertion of the nozzle dams blocks access to the nozzle-to-safe end welds. During the cycle 3 refueling outage, radiation exposure measured at the bottom of steam generator 1 bowl was 3.6 Rem on the hot leg side and 6.0 Rem on the cold leg side. It is estimated that set-up for radiographic examination of the nozzle-to-safe end welds with the nozzle dams removed would take 2 men approximately 3 hours for each nozzle, with approximately 1 hour required inside the bowl. Radiographic personnel would receive a dose of approximately 3.6 to 6 Rem for each nozzle-to-safe end weld radiographic set-up. This does not include additional exposure for nozzle dam manipulation, nor exposure outside the steam generator head or inside the reactor vessel cavity while reactor coolant water is below the hot or cold legs. Radiography from the outside surface of the weld is also impractical due to a combination of the pipe wall thickness and volume of water inside the pipe."

"During the preservice inspection, examination volume for these two welds was also reported to be limited and the welds were included in Preservice Inspection Program Request for Relief ISI-4. Approval was obtained in NRC's Safety Evaluation Report for Watts Bar Nuclear Plant Units 1 and 2, (NUREG-0847) Supplement 10, Appendix Z, Section 3.4. Request for Relief 1-ISI-05 was submitted following examination of steam generators 2 and 3 nozzles during the Cycle 2 refueling outage. Request for Relief 1-ISI-05 was approved by the NRC in a Safety Evaluation issued on March 24, 2000.

There are two remaining nozzle-to-safe end welds required to be examined prior to the end of the first ten year interval. It is anticipated that based on the results of these examinations and the preservice examinations, code required examination coverage is not expected to be obtained for the remaining nozzle-to-safe end welds. Based upon actual coverage obtained following examination of those two remaining welds, it may be necessary to submit an additional relief request for those welds."

Licensee's Proposed Alternative Examination (as stated):
"A volumetric examination of the lower one-third volume of the steam generator nozzle-to-safe end welds was performed on accessible areas to the extent practical given the geometric configuration and piping materials of the nozzle-to-safe end butt welds. The code required surface examinations were acceptable on 100% of the weld length for these welds during the Cycle 3 refueling outage."

Evaluation: The Code requires 100% surface and volumetric examination for dissimilar metal safe-end welds. However, complete volumetric examination of the subject welds was limited by component geometry (extreme nozzle taper) and material properties (coarse grain structure of cast stainless steel). As supported by sketches, and examination reports attached to the licensee's request for relief, these restrictions limit access and make the Code volumetric coverage requirements impractical for the subject dissimilar metal welds. The geometric configuration of the weld joint prevents ultrasonic examination from the nozzle side and the austenitic piping material prevents two-directional coverage from the pipe side, thus precluding full volumetric examination coverage. To meet the ASME Code, Section XI coverage requirements, design modifications would be necessary to provide access for examination. Imposition of the Code requirements would result in a significant burden on the licensee.

The licensee considered radiographic examination of the subject welds as an alternative volumetric examination method. However, it was determined to be impractical due to radiation exposure and lack of access from the inside diameter of the nozzles. Radiography from the outside surface of the weld is also impractical due to a combination of the pipe wall thickness and volume of water inside the pipe.

The licensee obtained 61% and 65% of the ASME Code, Section XI volumetric examination coverage of welds RCF-F1-1-SE (cold leg nozzle) and RCF-D1-2-SE (hot leg nozzle), respectively. In addition, the licensee performed 100% of the required surface examinations on the subject welds. The volumetric examinations, combined with the Code-required surface examination obtained by the licensee, provides reasonable assurance structural integrity of the steam generator nozzle-to-safe end welds. Therefore, the BNL staff recommends that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

2.3 Request for Relief No. 1-ISI-09 for Residual Heat Removal Heat Exchanger Shell-to-Flange Weld (RHRHX-2-1A), Examination Category C-A, Item Number C1.10.

Code Requirement: ASME Section XI, 1989 Edition, Examination Category C-A, Item Number C1.10 requires volumetric examination of 100% of the pressure retaining RHR heat exchanger shell-to-flange welds, as defined by Figure IWC-2500-1.

Licensee's Code Relief Request: Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from performing the required volumetric examination on essentially 100% of the full volume of the RHR heat exchanger shell-to-flange weld.

Licensee's Basis for Requesting Relief (as stated):
"The design configuration of the RHR heat exchanger shell-to-flange weld precludes an ultrasonic examination of the required volume for the shell-to-flange weld. The location of the nozzle welds and support pads relative to the shell-to-flange weld is configured in such a manner that performance of an ultrasonic scan is limited to approximately 77% of the required examination volume."

"Due to design configuration of the RHR heat exchanger, volumetric examination of the shell-to-flange weld during the Unit 1 Cycle 3 outage resulted in less than essentially 100% of ASME code coverage being achieved. The location of the nozzle welds and support pads relative to the shell-to-flange weld is configured in such a manner that performance of an ultrasonic examination is limited to approximately 77% of the required volume. Volumetric examination of this weld is required in accordance with ASME Section XI Table IWC-2500-1, Examination Category C-A, Item Number C1.10. The full volume weld examination requirement is illustrated by Figure IWC-2500-1."

"Vendor drawing BEU-17811 (Attachment 3), View A-A provides a depiction of the nozzle and support pad configuration relative to the shell-to-flange weld. Vendor drawing D-17811 provides dimensions of the nozzle and support pad in the respective details. As noted, the outside diameter of the nozzle is 18-1/2 inches and the width of the support pad is 18 inches. These are mounted on the 22-5/16 inches wide shell. Ultrasonic scanning from the shell side of the shell-to-flange weld near the nozzles and support pads is limited. The limited area is shown on Examination Report R-0574 (Attachment 4)."

"This limitation was also documented during the preservice inspection period on preservice request for relief ISI-15 which was authorized in NRC's Safety Evaluation Report for Watts Bar Nuclear Plant (NUREG-0847), Supplement Number 10, Appendix Z, issued October 1992."

Note: Based on the RAI responses to Question (3) dated August 9, 2001, the licensee stated "The required VT-2 visual examination is performed during system pressure test in accordance with Technical Requirement Instruction 1-TRI-74-901-A, "ASME Section XI Functional System Pressure Test RHR System - Train A." RHR Heat Exchanger 1A is included in the test boundary of this instruction."

Licensee's Proposed Alternative Examination (as stated):
"A volumetric examination of the full volume of the RHR heat exchanger shell-to-flange weld was performed on accessible areas to the extent practical given the design configuration of the shell-to-flange weld."

Evaluation: The ASME Code, Section XI, requires essentially 100% volumetric examination of the RHR heat exchanger shell-to-flange weld RHRHX-2-1A according to Figure IWC-2500-1. It was determined that based on the licensee's photo of the subject

area and engineering drawings, complete examination coverage is limited by physical interferences from the permanently welded pipe-to-vessel reinforcing plates. To gain complete access for the subject weld would require design modifications. Imposition of this requirement would create a significant burden on the licensee. Therefore, the ASME Code, Section XI requirement is impractical.

The licensee has examined 77.4% of the volume of the subject weld with bi-directional coverage. In addition, the licensee performed a VT-2 visual examination during system leakage tests as required by the Technical Requirement Instruction 1-TRI-74-901-A, "ASME Section XI Functional System Pressure Test RHR System -Train A." RHR Heat Exchanger 1A is included in the test boundary of this instruction. The volumetric examinations performed and the VT-2 visual examination during system leakage tests, provides reasonable assurance of structural integrity of the steam generator nozzle-to-safe end welds. Therefore, the BNL staff recommends that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

2.4 Request for Relief No. 1-ISI-10 for Integrally Welded Attachments of the Boron Injection Tank Support, Examination Category C-C, Item Number C3.10, Code Case N-509.

Note: The licensee is using Code Case N-509 (11-25-92), "Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments," in lieu of the requirements of the Code for the examination of Class 1, 2, and 3 integrally welded attachments. Code Case N-509 has been approved conditionally for general use in Regulatory Guide 1.147, Rev. 12. The condition stated in the Regulatory Guide is that a minimum 10% sample of integrally welded attachments for each item in each code class per interval should be examined.

Code Requirement: ASME Code, Section XI, Table 2500-1, Examination Category C-C, Item Number C3.10 requires surface examination of 100% of the integrally welded attachments (BIT-5-IA, BIT-6-IA, BIT-7-IA, and BIT-8-IA) to the Boron Injection Tank support, as defined in Figure IWC-2500-5.

Licensee's Code Relief Request: Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from performing the required surface examination on essentially 100% of the examination surface of the Boron Injection Tank integrally welded attachments.

Licensee's Basis for Requesting Relief (as stated):
"The design configuration of the Boron Injection Tank integrally welded attachments preclude a surface examination of the required area. The design configuration limits the surface examination of the code required examination surface area to approximately 78% on each of the four integrally welded attachments."

"Due to configuration of the boron injection tank support, surface examination of the integrally welded attachments during the Unit 1 Cycle 3 refueling outage resulted in less than essentially 100% of ASME Code coverage being achieved. The tank is supported by four legs which are attached to the tank by four 16-inch X 12.5-inch pads welded directly to the shell. The pads are considered integrally welded attachments and are required to be examined by a surface method in accordance with Code Case N-509

Table 2500-1, Examination Category C-C, Item Number C3.10. The surface examination requirement is illustrated by Figure IWC-2500-5(b). As indicated on ISI Drawing, ISI-0053-C-01, the support leg covers the lower end of the pad preventing the surface examination on this 12.5-inch portion of the weld. The examination resulted in approximately 78% of code required coverage being achieved on each of the 4 integrally welded attachments. A typical description of the limited examination area is documented on examination report R-0600 (Attachment 3)."

"It would be impractical to remove the support leg as the legs are welded directly to the support pad. Other examination methods were also considered but cannot be performed due to the access limitation."

Licensee's Proposed Alternative Examination (as stated):
"A surface examination of the boron injection tank integrally welded attachments was performed on accessible areas to the extent practical given the design configuration of the tank and attachment."

Evaluation: The ASME Code, Section XI requires 100% surface examination of the subject integrally welded attachments (four 16"x12.5" pads welded directly to the shell). It was determined that based on the licensee's drawings and examination reports, complete examination coverage is impractical due to restricted access caused by the design configuration of the integrally welded attachments (i.e., pads) and the legs attached to the tank in the Boron Injection Tank. In order for the licensee to meet the ASME Code, Section XI coverage requirements, design modifications to the subject welds would be necessary to provide access for examination. Imposition of the Code requirements would result in a significant burden on the licensee. Therefore, surface examination of the subject integral attachment welds is impractical to perform.

The licensee completed 78% of the ASME Code, Section XI liquid penetrant examination surface examinations for each of the subject components. It was determined that based upon the surface coverage obtained, existing patterns of degradation, if present, would have been detected. The surface examination performed by the licensee provides reasonable assurance of the structural integrity of the subject integral attachment welds. Therefore, the BNL staff recommends that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

2.5 Request for Relief No.1-ISI-11 for the Boron Injection Tank Shell-to-Head Circumferential Welds, Examination Category C-A, Item Number C1.20.

Code Requirement: ASME Code, Section XI, 1989 Edition, Examination Category C-A, Item Number C1.20 requires volumetric examination of 100% of the pressure-retaining Boron Injection Tank shell-to-head circumferential welds (BIT-2 and BIT-3), as defined by Figure IWC-2500-1.

Licensee's Code Relief Request: Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from performing the required volumetric examination on essentially 100% of the full volume of the Boron Injection Tank shell-to-head circumferential welds.

Licensee's Basis for Requesting Relief (as stated):
"The geometric configuration (taper) of the shell and the CF8A shell material prevents an effective scan from the shell side which prevents full examination coverage. The design configuration limits ultrasonic examination of the code required examination volume to approximately 60% for weld BIT-2 and 63% for weld BIT-3."

"Volumetric examination of this component is required in accordance with ASME Section XI Table IWC-2500-1, Examination Category C-A, Item Number C1.20. The full volume weld examination requirement is illustrated by Figure IWC-2500-1."

"Vendor drawing E110048 Sheet 1 of 2 (Attachment 3) shows the shell-to-head configuration. As noted on Examination Reports R-0690 and R-0691 (Attachment 4), no scan was performed from the shell side of the weld. The shell material is SA-351, CF8A. With present technology, only a 45^{o} RL large transducer scan is being performed on CF8A material. Due to the taper of the shell, i.e. the 3:1 minimum bevel due to wall thickness differences between the shell and head, the 45^{o} scan would be ineffective. As described on the examination reports, approximately 60% code coverage for the weld BIT-2 and 63% code coverage for weld BIT-3 was achieved on the required weld examination volume."

Note: Based on the RAI responses to Question (2) dated August 9, 2001, the licensee stated "The required VT-2 visual examination is performed during system pressure testing in accordance with Technical Requirement Instruction 1-TRI-62-902, "ASME Section XI Inservice System Pressure Test - CVCS Outside Containment." The Boron Injection Tank is included in the test boundary of this instruction."

Licensee's Proposed Alternative Examination (as stated):
"The code required 100% volumetric examination of the full volume of the boron injection tank shell-to-head circumferential welds was performed on accessible areas to the extent practical given the design configuration of the shell-to-head weld."

Evaluation: The Code requires essentially 100% volumetric examination of the Boron Injection Tank shell-to-head circumferential welds, BIT-2 and BIT-3, according to Figure IWC-2500-1. It was determined that based on the licensee's engineering drawings, complete examination coverage is limited due to the taper of the shell. The geometric configuration (taper) of the shell and the CF8A shell material prevents an effective scan from the shell side. With present technology, only a 45^{0} RL large transducer scan is being performed on CF8A material. However, due to the taper of the shell this scan would be ineffective. To meet the Code coverage requirements, design modifications would be necessary to provide access for ASME Code, Section XI examination. Imposition of this requirement would create a significant burden on the licensee. Therefore, the ASME Code, Section XI 100% volumetric examinations are impractical.

The licensee obtained 60% coverage for weld BIT-2 and 63% coverage for weld BIT-3. In addition, the licensee performed a VT-2 visual examination during system leakage tests as required by the Technical Requirement Instruction 1-TRI-62-902, "ASME Section XI Functional System Pressure Test - CVCS Outside Containment." The Boron Injection Tank is included in the test boundary of this instruction. The examinations

performed and the VT-2 visual examination during system leakage tests provide reasonable assurance of structural integrity of the subject welds. Therefore, the BNL staff recommends that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

2.6 Request for Relief No. 1-ISI-12 for the Boron Injection Tank Nozzle-to-Head Welds, Examination Category C-B, Item Number C2.21.

Code Requirement: ASME Code, Section XI, 1989 Edition, Examination Category C-B, Item Number C2.21 requires both volumetric and surface examinations of 100% of the pressure retaining Boron Injection Tank Nozzle-to-Head welds (BIT-1 and BIT-4), as defined by Figure IWC-2500-4(a).

Licensee's Code Relief Request: Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from performing the required volumetric examination on essentially 100% of the lower one-third volume of the Boron Injection Tank nozzle-to-head welds.

Licensee's Basis for Requesting Relief (as stated):
"The design configuration of the boron injection tank nozzle-to-head welds preclude a full volumetric examination of the required volume for the weld. The design configuration limits ultrasonic examination of the code required examination volume to approximately 80%."

"Volumetric examination of the boron injection tank nozzle-to-head welds during the Unit 1 Cycle 3 refueling outage resulted in less than essentially 100% of ASME code coverage being achieved due to configuration of the nozzles. The configuration of the nozzles prevents ultrasonic examination from the nozzle side, thus preventing full coverage of the required lower one-third examination volume. Volumetric examination of this component is required in accordance with ASME Section XI Table IWC-2500-1, Examination Category C-B, Item Number C2.21. The lower one-third volume weld examination requirement is illustrated by Figure IWC-2500-4(a)."

"The nozzles are shown in detail on Vendor Drawing 1100E48 Sheet 2 of 2, details F and S (Attachment 3 [sic]. As noted on examination reports R-0689 and R-0692 (Attachment 4), no ultrasonic scans were performed from the nozzle side of the weld due to the nozzle configuration. A 100% bi-directional coverage was achieved with a 45^{o} scan by scanning over the weld onto the nozzle side. The design configuration limits ultrasonic examination of the code required examination volume to approximately 80%. No indications were detected. The code required surface examination was performed on the welds and was acceptable as documented on examination reports R-0578 and R-0583 (Attachment 4)."

Note: Based on the RAI responses to Question (1) dated August 9, 2001, the licensee stated: "The BI Tank is a vessel with wall thickness greater than 2.0-inches (see drawing No. ISI-0053-C-01, Enclosure 6, Attachment 1 of the February 21, 2001 submittal). The procedure used to perform the nozzle to vessel examinations was Procedure N-UT-77, "Ultrasonic Examination of Weld in Vessels Greater Than 2-Inches in Wall Thickness Made From Austenitic or High Nickel Alloy Materials," which conforms with ASME Section V, Article 5, 1989 Edition. Article 5 requires the examination to be performed

with two angles (normally 45 and 60-degrees). Because examination cannot be achieved using the 'bounce' (second leg) of the 60 degree refracted longitudinal waves, the weld did not receive bi-directional coverage, normal to the weld, with the required two angles."

Licensee's Proposed Alternative Examination (as stated):
"The code required 100% volumetric examination of the lower one-third volume of the boron injection tank nozzle-to-head weld was performed on accessible areas to the extent practical given the design configuration of the shell-to-flange weld. The code required surface examination was performed on both welds and was acceptable as documented on examination reports R-0578 and R-0583 (Attachment 4)."

Evaluation: The Code requires 100% surface and volumetric examination for the boron injection tank nozzle-to-head welds (BIT-1 and BIT-4). Complete volumetric examination of the subject welds was limited by the design configuration of the shell-to-flange welds. It was determined that based on the licensee's design drawings and examination reports, the ASME Code, Section XI volumetric coverage requirements are impractical for the subject welds. In addition, ultrasonic scans were not performed from the nozzle side of the welds due to the nozzle configurations. In accordance with Section V, Article 5 of the Code, the examination should be performed with two angles (normally 45 and 60 degrees). A 100% bi-directional coverage was achieved with a 45 degree scan by scanning over the weld onto the nozzle side. Because examination cannot be achieved using the 'bounce' (second leg) of the 60 degree refracted longitudinal waves, the welds did not receive bi-directional coverage, normal to the weld, with the Code-required two angles. To meet the ASME Code, Section XI, coverage requirements, design modifications would be necessary to provide access for examination. Imposition of the Code requirements would result in a significant burden on the licensee.

The licensee obtained 80% of the required ASME Code, Section XI volumetric examination coverage. In addition, the licensee performed 100% of the required surface examinations on the subject welds. The partial volumetric examinations, combined with the Code-required surface examination, provides reasonable assurance of structural integrity of the boron injection tank nozzle-to-head welds. Therefore, the BNL staff recommends that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

3. CONCLUSION

The BNL staff evaluated the licensee's submittal and determined that certain inservice examinations cannot be performed to the extent required by the Code at the Watts bar Nuclear Plant, Unit 1. For Requests for Relief 1-ISI-07 through 1-ISI-12 the BNL staff concludes that the Code requirements are impractical and to meet the Code coverage requirements, design modifications would be necessary to provide access for examination. Imposition of the Code requirements would result in a significant burden on the licensee. BNL further concludes that the examinations performed provide reasonable assurance of structural integrity of the subject welds. Therefore, BNL recommends that Requests for Relief 1-ISI-07 through 1-ISI-12 be granted pursuant to 10 CFR 50.55a(g)(6)(i) for the first 10-year ISI interval.