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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
OF THE
FIRST 10 YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN
REQUEST FOR RELIEF ISPT-07
FOR
TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT
DOCKET NUMBER 50-390

## 1.0 INTRODUCTION

The Technical Specifications for the Watts Bar Nuclear Plant (WBN) state that the inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel (B&PV) Code and applicable addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the U.S. Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). The 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (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 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 applicable edition of Section XI of the ASME Code for the WBN first 10-year ISI interval is the 1989 Edition.

Pursuant to 10 CFR 50.55a(g)(5), if the Tennessee Valley Authority (licensee) determines that conformance with an examination requirement of Section XI of the ASME Code is not practical for its facility, information shall be submitted to the Commission in support of that determination and a request made for relief from the ASME Code requirement. After evaluation of the determination, pursuant to 10 CFR 50.55a(g)(6)(i), the Commission may grant relief and may impose alternative requirements that are determined to be

authorized by law, will not endanger life, property, or the common defense and security, and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed.

In a letter dated May 9, 1996, the licensee submitted to the NRC its first 10-year inservice inspection interval program plan and associated requests for relief for the Watts Bar Nuclear Plant. Requests for Relief ISPT-02, ISPT-03, and ISPT-06, are part of a present review by the staff of the licensee's first 10-year interval inservice inspection program plan and associated requests for relief for the Watts Bar Nuclear Plant. The licensee requested that the review of Requests for Relief ISPT-02, ISPT-03, and ISPT-06 be expedited, because they are required for the 1997 fall outage. Additional information was provided by the licensee in its letters dated March 24, 1997 and August 8, 1997.

## 2.0 EVALUATION

The staff, with technical assistance from its contractor, the Idaho National Engineering and Environmental Laboratory (INEEL), has evaluated the information provided by the licensee in support of its First 10-Year Inservice Inspection Interval Program Plan Requests for Relief ISPT-02, ISPT-03, and ISPT-06, for the Watts Bar Nuclear Plant. Based on the information submitted, the staff adopts the contractor's conclusions and recommendations presented in the Technical Letter Report (TLR) attached.

### 2.1 Request for Relief ISPT-02 (Revised 3/24/97), Use of ASME Code Case N-416-1, "*Alternative Pressure Test Requirements for Welded Repairs or Installation of Replacements Items by Welding*"

Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee proposed to use ASME Code Case N-416-1, "*Alternative Pressure Test Requirements for Welded Repairs or Installation of Replacements Items by Welding*" as an alternative to the Code requirements. Section XI of the Code requires a system hydrostatic test to be performed in accordance with IWA-5000 after repairs by welding on the pressure-retaining boundary. The licensee proposes to implement the alternative requirements to hydrostatic pressure tests contained in Code Case N-416-1 for Code Class 1, 2, and 3 repairs/replacements. In addition, for Class 3 repair/replacement welds or welded areas the licensee will supplement the pressure test with an additional surface examination on the root pass layer.

Code Case N-416-1 specifies that nondestructive examination (NDE) of the welds be performed in accordance with the applicable subsection of the 1992 Edition of Section III. This Code Case also allows a VT-2 visual examination to be performed at nominal operating pressure and temperature in conjunction with a system leakage test, in accordance with paragraph IWA-5000 of the 1992 Edition of Section XI. Comparison of the system pressure test requirements of the 1992 Edition with those of the 1989 Edition of Section XI, the latest Code edition referenced in 10 CFR 50.55a, shows that:

- the test frequencies and pressure conditions are unchanged;
- the hold times either remained the same or increased;
- the terminology associated with the system pressure test requirements for all three Code classes has been clarified and streamlined; and
- the NDE requirements for welded repairs remain the same.

Hardships are generally encountered with the performance of hydrostatic testing in accordance with the Code. Hydrostatic pressure testing frequently requires a significant effort to set up and perform due to the need to use special equipment, such as temporary attachment of test pumps and gages, and the need for unique valve lineups.

Hydrostatic testing only subjects the piping components to a small increase in pressure over the design pressure and, therefore, does not present a significant challenge to pressure boundary integrity. Accordingly, hydrostatic pressure testing is primarily regarded as a means to enhance leak detection during the examination of components under pressure, rather than as a measure of the structural integrity of the components.

Following welding, the Code requires volumetric examination (depending on wall thickness) of repairs or replacements in Code Class 1 and 2 piping components, but only requires a surface examination of the final weld pass in Code Class 3 piping. There are no ongoing NDE requirements for Code Class 3 components except for VT-2 visual examination for leaks in conjunction with the 10-year hydrostatic tests and the periodic pressure tests.

Considering the NDE performed on Code Class 1 and 2 systems, and that the hydrostatic pressure tests rarely result in pressure boundary leaks that would not occur during system leakage tests, the staff believes that the increased assurance of pressure boundary integrity of Class 1 and 2 welds that could be achieved is not commensurate with the burden of performing hydrostatic testing. However, considering the nature of NDE requirements for Code Class 3 components, the staff does not believe that elimination of the hydrostatic pressure testing is an acceptable alternative to hydrostatic testing unless additional surface examinations are performed on the root pass layer of butt and socket welds on the pressure retaining boundary of Class 3 components when the surface examination method is used in accordance with Section III. The licensee's alternative includes performance of additional surface examinations on the root pass layer of butt and socket welds on the pressure retaining boundary of Class 3 components.

Compliance with Code hydrostatic testing requirements for welded repairs or replacements of Code Class 1, 2, and 3 components would result in a hardship without a compensating increase in the level of quality and safety in that the alternative is adequate to ensure weld integrity. Therefore, the staff concludes that the licensee's proposed alternative, including the performance of additional surface examinations on the root pass layer of butt and socket welds on the pressure retaining boundary of Class 3 components when the surface examination method is used in accordance with Section III, is authorized, pursuant to 10 CFR 50.55a(a)(3)(ii).

Use of Code Case N-416-1, with the licensee's proposed surface examination of the root pass layer for Class 3 repairs, is authorized for the current interval or until such time as the Code Case is published in Regulatory Guide 1.147. At that time, if the licensee intends to continue to implement this Code Case, the licensee should follow all provisions in Code Case N-416-1, with limitations issued in Regulatory Guide 1.147, if any.

2.2 Request for Relief ISPT-03 (Revised 8/8/97), Section XI, IWA-5250(a)(2), Corrective Action Resulting from Leakage at Bolted Connections

Section XI, IWA-5250(a)(2), Corrective Action Resulting from Leakage at Bolted Connections requires that the source of leakage detected during a system pressure test shall be located and evaluated by the Owner for corrective action. When the leakage is at a bolted connection, the bolting shall be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100. Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the ASME Section XI requirements for removal of bolting at leaking connections for VT-3 visual examination. The licensee proposed that when evidence of leakage is discovered at a bolted connection during a Section XI inservice pressure test, the connection is evaluated for corrosion and structural integrity with consideration of the following factors, at a minimum:

A. size of leak;
B. duration of leak;
C. the cause of the leak;
D. bolting and flange material;
E. visual evidence of corrosion with the connection assembled;
F. corrosive properties of the fluid in relation to the bolting and flange material;
G. experience with similar bolting material in similar environments;
H. location of leak, including degradation of other components in the vicinity of the leakage; and
I. history of leakage at this location.

When the evaluation of the above variables determines that the leaking condition has not degraded the fasteners and the bolted connection possesses sufficient strength to maintain the structural integrity of the joint, then no further action is necessary. However, reasonable attempts to stop the leakage shall be taken. If the evaluation of the above variables indicates the need for further evaluation, or, if no evaluation is performed, then the bolt most affected by the leakage will be removed and examined. The bolt will receive a visual VT-1 examination, and be evaluated in accordance with IWB-3140, "Inservice Inspection Visual Examinations." This visual VT-1 examination may be deferred to the next outage of sufficient duration if the evaluation supports continued service. When the removed bolting shows evidence of rejectable degradation, the remaining bolts shall be removed and receive a visual VT-1 examination and evaluation in accordance with IWB-3140.

In accordance with the 1989 Edition of the Code, when leakage occurs at bolted connections, all bolting is required to be removed for visual examination. In

lieu of the Code-required removal of bolting, the licensee has proposed to perform an evaluation of the bolted connection to determine the susceptibility of the bolting to corrosion and the potential for failure.

The proposed alternative allows the licensee to utilize a systematic approach and sound engineering judgement, based on the nine evaluation factors listed in the licensee's proposal. Furthermore, if the initial evaluation indicates the need for a more in-depth evaluation, the bolt closest to the source of leakage will be removed, VT-1 examined, and evaluated in accordance with IWB-3140 as stated in the proposed alternative.

Requiring removal of bolting as part of the corrective action when leakage occurs at a bolted connection would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee's alternative to the Code-required removal of bolting will provide reasonable assurance of the operational readiness of the bolted connection, as the integrity of the joint will be maintained. Therefore, the staff concluded that the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii).

2.3 Request for Relief ISPT-06 (Revised 8/8/97), Use of ASME Code Case N-533, *Alternative Requirements for VT-2 Visual Examination of Class 1 Insulated Pressure-Retaining Bolted Connections*

Section XI, Paragraph IWA-5242(a) requires the removal of all insulation from pressure-retaining bolted connections in systems borated for the purpose of controlling reactivity when performing VT-2 visual examinations during system pressure tests. Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee proposed to use the alternative contained in Code Case N-533, *Alternative Requirements for VT-2 Visual Examination of Class 1 Insulated Pressure-Retaining Bolted Connections*, for Class 1 bolting in borated systems. This Code Case allows the VT-2 visual examination to be performed in conjunction with startup following a 4-hour hold time at operating pressure with the insulation in place. A VT-2 visual examination is then performed each refueling outage during cold shutdown with the insulation removed. Use of this Code Case will significantly reduce the personnel hazards associated with the extreme heat and potential radiation exposure during the VT-2 examination with the insulation removed and subsequent replacement of the insulation prior to the run cycle.

When bolted connections are examined in accordance with Code Case N-533, the joints are VT-2 visually examined at operating pressure with the insulation in place during the start-up pressure test and again at cold shutdown during each refueling outage with the insulation removed (the system need not be pressurized for this portion of the examination). Based on this frequency of examinations, it can be concluded that the bolted joint integrity will be verified at the same frequency currently required by the Code. Significant leakage during the pressure test would be detected by the VT-2 visual examination performed with the insulation in place. If leakage occurs, corrective action would be necessary to meet minimum technical specification requirements.

Compliance with the Code requirements would require holding the unit in the hot standby mode after completion of the VT-2 examination to allow replacement of the thermal insulation and removal of scaffolding. This situation would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, the staff concluded that the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the current interval or until such time as the Code Case is published in Regulatory Guide 1.147. At that time, if the licensee intends to continue to implement this Code Case, the licensee should follow all provisions in Code Case N-533, with limitations issued in Regulatory Guide 1.147, if any.

## 3. CONCLUSIONS

The staff concludes that for Relief Requests ISPT-02, ISPT-03, and ISPT-06, the licensee has demonstrated that specific Section XI requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee's proposed alternatives are authorized.

The licensee's proposed alternatives to use Code Cases N-416-1 and N-533 contained in Requests for Relief ISPT-02 and ISPT-06, respectively, are authorized for the current interval or until such time as the Code Cases are published in Regulatory Guide 1.147. At that time, if the licensee intends to continue to implement these Code Cases, the licensee should follow all provisions in Code Cases N-416-1 and N-533, with limitations issued in Regulatory Guide 1.147, if any.

Attachment: INEEL TLR

Principle Contributor: T. McLellan

Date: September 23, 1997

# TECHNICAL LETTER REPORT
# FIRST 10-YEAR INSERVICE INSPECTION INTERVAL
# RELIEF REQUESTS ISPT-02, ISPT-03, & ISPT-06
# FOR
# TENNESSEE VALLEY AUTHORITY
# WATTS BAR NUCLEAR PLANT
# DOCKET NUMBER 50-390

## 1.0 INTRODUCTION

By letter dated May 9, 1996, Tennessee Valley Authority submitted the inservice inspection (ISI) program plan for the first ten-year interval at Watts Bar Nuclear Plant. Included in this submittal were Requests for Relief ISPT-02, ISPT-03, and ISPT-06. In response to Nuclear Regulatory Commission requests for additional information, the licensee submitted a final revision to ISPT-02 on March 24, 1997, and final revisions to ISPT-03 and ISPT-06 on August 8, 1997. Per the licensee's request, the evaluation of these three Requests for Relief is being expedited by this Technical Letter Report. The program plan and other associated requests for relief are being evaluated by separate report. The Idaho National Engineering and Environmental Laboratory (INEEL) staff has evaluated the subject requests in the following section.

## 2.0 EVALUATION

The applicable edition of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, for Watts Bar Nuclear Plant first ten-year ISI interval is the 1989 Edition. The information provided by the licensee in support of the request has been evaluated and the basis for disposition is documented below.

ATTACHMENT

A. Request for Relief ISPT-02 (Revised per letter dated 3/24/97), Alternative Pressure Test for Welded Repairs or Replacements in Class 1, 2, and 3 Systems

Code Requirement: Section XI, IWA-4400(a) requires that a system hydrostatic test be performed in accordance with IWA-5000 after repairs by welding in a pressure-retaining boundary.

Licensee's Proposed Alternative: Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the Code required ASME Section XI pressure tests at elevated hydrostatic test pressures for Class 1, 2, and 3 repairs/replacements. The licensee stated:

"The alterative requirements of ASME Code Case N-416-1 shall be used. In addition, when performing repairs by welding or the installation of replacements by welding on the pressure retaining boundary of Code Class 3 components, additional surface examination shall be performed on the root pass layer of the weld when the surface examination method is used in accordance with ND-5222."

Licensee's Basis for the Proposed Alternative: (as stated)

"Class 1, 2, and 3 pressure boundary replacements requiring installation by welding are normally constructed and supplied in accordance with the requirements of ASME Section III which provides for hydrostatic testing at the manufacturers. Subsequent to installation hydrostatic pressure testing is a means of proving weld leak tight integrity. Performing NDE and invoking acceptance criteria in accordance with current ASME III requirements in addition to a system leakage test provides reasonable assurance that weld leak tight integrity is maintained at an acceptable level of quality.

"The acceptability of performing nominal operating pressure tests in lieu of hydrostatic tests is supported by the recent approval by the American Society of Mechanical Engineers (ASME), Board of Nuclear Codes and Standards, of ASME Code Case N-416-1, "Alternative Pressure Test Requirements for Welded Repairs or Installation of Replacements Items by Welding." This code case allows a system leakage test at nominal operating pressure and temperature to be used in lieu of a hydrostatic test, provided that NDE of the weld(s) is performed in accordance with the methods and acceptance criteria of the applicable Subsection of the 1992 Edition of the ASME Boiler and Pressure Vessel Code, Section III. This guidance is sufficient for Code Class 1 and 2 components since the code requires volumetric examination of repairs or replacement in Code Class 1 and 2 components. However, the code only requires a surface examination of the final weld pass for

Code Class 3 components. Accordingly, the proposed request for relief supplements the examination requirements specified in N-416-1 with an additional surface examination of the root pass when Subparagraph ND-5222 requires a surface examination of the final weld.

"Piping components are designed for a number of loadings that would be postulated to occur under the various modes of plant operation and accidents. These include the stresses from internal pressure as well as the stress from the weight of the component and other stresses as may be present during an accident, such as jet forces or seismic loadings. Hydrostatic testing subjects the piping and components to only a small increase in pressure over the design pressure, and, therefore, does not present a significant change in the total pressure boundary stress. Accordingly, hydrostatic pressure testing is primarily regarded as a means to enhance leakage detection during the examination of a component under pressure, rather than a measure to determine the structural integrity of component.

"Industry experience has been that leaks are not being discovered as a result of hydrostatic test pressures propagating a preexisting flaw through wall. Experience indicates that when leaks are found, in most cases, they are found when the system is at normal operating pressure. This is largely due to the fact that hydrostatic pressure testing is required only upon installation and then once every 10-year inspection interval, while system leakage tests at nominal operation pressures are conducted a minimum of once each refueling outage for Class 1 systems and each 40-month inspection period for Class 2 and 3 systems. The leaks that are being identified are being found during the more frequent system leakage tests. In addition, leaks may be identified by plant operators during routine system walkdowns.

"Following the performance of welding on the pressure boundary, the Code requires volumetric examination of repairs or replacements in Code Class 1 and 2 systems, but only requires a surface examination of the final weld pass in Code Class 3 systems. Additionally, there are periodic requirements to perform NDE of certain Code Class 3 components, except for visual examination for leaks in conjunction with the periodic system pressure tests.

"Considering the NDE performed Code Class 1 and 2 systems and considering that the hydrostatic pressure tests rarely result in pressure boundary leaks that would not occur during system leakage tests there is very little increased assurance of the integrity of Class 1 and 2 systems added by the hydrostatic test requirement.

"However, considering the nature of NDE requirements for Code Class 3 components, the same level of assurance cannot be established. Accordingly, an additional requirement to perform a surface examination on the root pass layer of butt and socket welds in the pressure retaining boundary of Code Class 3 components when the surface examination method is specified in accordance with Section III is being incorporated. With this provision applied to Code Class 3 components, it is our conclusion that the substitution of system pressure tests at

operating pressures and temperatures for the elevated pressure hydrostatic test does not present an unsafe or adverse condition. It is WBN's position that the performance of hydrostatic pressure tests subsequent to weld repairs and the installation of welded replacements could not only expose components to unnecessary stress levels, but is a hardship which provides little or no increase in the level of quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that relief be granted."

Evaluation: Section XI of the Code requires a system hydrostatic test to be performed in accordance with IWA-5000 after repairs by welding on the pressure-retaining boundary. The licensee proposes to implement the alternative requirements to hydrostatic pressure tests contained in Code Case N-416-1 for Code Class 1, 2, and 3 repairs/replacements. In addition, for Class 3 repair/replacement welds or welded areas the licensee will supplement the pressure test with an additional surface examination on the root pass layer.

Code Case N-416-1 specifies that nondestructive examination (NDE) of the welds be performed in accordance with the applicable subsection of the 1992 Edition of Section III. This Code Case also allows a VT-2 visual examination to be performed at nominal operating pressure and temperature in conjunction with a system leakage test, in accordance with paragraph IWA-5000 of the 1992 Edition of Section XI. Comparison of the system pressure test requirements of the 1992 Edition with those of the 1989 Edition of Section XI, the latest Code edition referenced in 10 CFR 50.55a, shows that:

- the test frequencies and pressure conditions are unchanged;
- the hold times either remained the same or increased;
- the terminology associated with the system pressure test requirements for all three Code classes has been clarified and streamlined; and
- the NDE requirements for welded repairs remain the same.

Hardships are generally encountered with the performance of hydrostatic testing in accordance with the Code. Hydrostatic pressure testing frequently requires a significant effort to set up and perform due to the need to use special equipment,

such as temporary attachment of test pumps and gages, and the need for unique valve lineups.

Hydrostatic testing only subjects the piping components to a small increase in pressure over the design pressure and, therefore, does not present a significant challenge to pressure boundary integrity. Accordingly, hydrostatic pressure testing is primarily regarded as a means to enhance leak detection during the examination of components under pressure, rather than as a measure of the structural integrity of the components.

Following welding, the Code requires volumetric examination (depending on wall thickness) of repairs or replacements in Code Class 1 and 2 piping components, but only requires a surface examination of the final weld pass in Code Class 3 piping. There are no ongoing NDE requirements for Code Class 3 components except for VT-2 visual examination for leaks in conjunction with the 10-year hydrostatic tests and the periodic pressure tests.

Considering the NDE performed on Code Class 1 and 2 systems, and that the hydrostatic pressure tests rarely result in pressure boundary leaks that would not occur during system leakage tests, the INEEL staff believes that the increased assurance of pressure boundary integrity of Class 1 and 2 welds that could be achieved is not commensurate with the burden of performing hydrostatic testing. It is also believed that the added assurance provided by a hydrostatic test of Class 3 welds is not commensurate with the burden of hydrostatic testing when 1) a surface examination is performed on the root pass layer of butt and socket welds, and 2) a system pressure test is performed.

Compliance with Code hydrostatic testing requirements for welded repairs or replacements of Code Class 1, 2, and 3 components would result in a hardship without a compensating increase in the level of quality and safety. Therefore, it is recommended that the proposed alternative be authorized, pursuant to

10 CFR 50.55a(a)(3)(ii). Use of Code Case N-416-1, with the licensee's proposed surface examination of the root pass layer for Class 3 repairs, should be authorized for the current interval or until such time as the Code Case is published in Regulatory Guide 1.147. At that time, if the licensee intends to continue to implement this Code Case, the licensee should follow all provisions in Code Case N-416-1, with limitations issued in Regulatory Guide 1.147, if any.

- Request for Relief ISPT-03 (Revised per letter dated 8/8/97), IWA-5250(a)(2), Corrective Action Resulting from Leakage at Bolted Connections

Code Requirement: IWA-5250(a)(2) requires that the source of leakage detected during a system pressure test shall be located and evaluated by the Owner for corrective action. When the leakage is at a bolted connection, the bolting shall be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100.

Licensee's Proposed Alternative: Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the ASME Section XI requirements for removal of bolting at leaking connections for VT-3 visual examination. The licensee stated:

"When evidence of leakage is discovered at a bolted connection during a Section XI inservice pressure test, the connection is evaluated for corrosion and structural integrity with consideration of the following factors, at a minimum:

A. size of leak;
B. duration of leak;
C. the cause of the leak;
D. bolting and flange material;
E. visual evidence of corrosion with the connection assembled;
F. corrosive properties of the fluid in relation to the bolting and flange material;
G. experience with similar bolting material in similar environments;
H. location of leak, including degradation of other components in the vicinity of the leakage; and
I. history of leakage at this location."

"When the evaluation of the above variables determines that the leaking condition has not degraded the fasteners and the bolted connection possesses sufficient strength to maintain the structural integrity of the joint, then no further action is necessary. However, reasonable attempts to stop the leakage shall be taken. If the evaluation of the above variables indicates the need for further evaluation, or, if no evaluation is performed, then the bolt most affected by the leakage will be removed and examined. The bolt will receive a visual VT-1 examination, and be evaluated in accordance with IWB-3140, "Inservice Inspection Visual Examinations." This visual VT-1 examination may be deferred to the next outage of sufficient duration if the evaluation supports continued service. When the removed bolting shows evidence of rejectable degradation, the remaining bolts shall be removed and receive a visual VT-1 examination and evaluation in accordance with IWB-3140."

Licensee's Basis for the Proposed Alternative: (as stated)

"The 1989 Edition of Section XI requires that all bolting must be removed in the event of a bolted connection leak for the purpose of VT-3 examination and evaluation. The 1990 Addenda to the 1989 Edition of Section XI and later editions recognize that the removal of all the bolting in the connection is unnecessary, if the bolt most affected by the leakage is examined and found to be acceptable by the VT-3 examination. Additionally, the removal of all bolting is unnecessary if the bolting utilized is of a material which is not susceptible to corrosion when in contact with the leaking fluid, such as stainless steel bolting in contact with either water or borated water. The requirement in the 1989 Edition could require placing the associated component or portion of piping out of service possibly resulting in plant shutdown, delaying plant startup, or placing the plant in an unsafe condition for continued operation. Operating experience at TVA's other nuclear plants has indicated that it is not always possible to remove a single bolt from a joint. Therefore, the requirement of the 1990 Addenda to the 1989 Edition, cannot always be met. In the case of bolting being removed from a valve bonnet joint or a pump casing joint, it is not always possible to remove the bolt without incurring damage (galled threads) to the component, thus necessitating an additional repair prior to return to service.

"ASME Section XI inservice pressure tests are, as a rule, performed with the system inservice. In particular, the Code Class 1 leakage test and several system inservice or functional tests for Code Class 2 systems that interface with the reactor coolant system are performed as the unit is returning to service following each refueling outage. Unnecessary delays for removal and evaluation of bolting at a leaking connection would delay return of the unit to service. Additionally, for systems that are normally inservice in support of normal plant operation during testing, paragraph IWA-5250(a)(2) may require the system be taken out of service and depressurized to permit removal of one of the bolts for visual examination. For certain systems this could require the unit to be removed from production dependent upon the existing plant and equipment status and the time necessary to remove and replace the bolting.

"Although removal and inspection of a fastener is necessary to determine the full extent of corrosion to that particular fastener, this may not be necessary to evaluate the structural integrity of the bolted connection. The structural integrity of the bolted connection is dependent upon several factors including the amount of leakage, the duration of leakage from inception to correction, the corrosiveness of the fluid, the bolting and flange materials, the number of bolts and the number of these exposed to the fluid, and a visual evaluation of the connection for corrosion and material loss.

"An engineering evaluation of the leak and effected mechanical connection can determine whether sufficient strength exists in the connection to preserve its structural integrity until the next system outage without a reduction in component safety margin or whether removal of bolting for visual examination in compliance with paragraph IWA-5250(a)(2) must be performed at the present time.

"The experience at other TVA nuclear plants, which have a combined total of over 40 years of nuclear unit operation, indicates that, although leaks and subsequent corrosion of fasteners do occur at bolted connections, no failures of fasteners has occurred prior to the detection of the leakage and its repair. This experience demonstrates that the connections have been designed with sufficient safety margin to prevent the failure of bolted connections prior to detection of leakage. In addition to the Section XI inservice pressure test program, WNB utilizes a Borated Water Corrosion Program and plant housekeeping procedures to identify system leaks.

"The requirement to immediately remove bolting from a mechanical connection when evidence of leakage is detected can create a hardship on the plant by requiring system and even plant shutdown. In view of past experience at TVA nuclear plants, the hardship invoked by this requirement is not commensurate with the increase in the level of quality or safety that is provided. It is the position of WBN that the requirement of the 1989 Edition of ASME Section XI to immediately remove bolting from a mechanical connection presents a hardship to the plant without providing a commensurate increase in the level of safety and quality."

Evaluation: In accordance with the 1989 Edition of the Code, when leakage occurs at bolted connections, all bolting is required to be removed for visual examination. In lieu of the Code-required removal of bolting, the licensee has proposed to perform an evaluation of the bolted connection to determine the susceptibility of the bolting to corrosion and the potential for failure.

The proposed alternative allows the licensee to utilize a systematic approach and sound engineering judgement, based on the nine evaluation factors listed in the

licensee's proposal. Furthermore, if the initial evaluation indicates the need for a more in-depth evaluation, the bolt closest to the source of leakage will be removed, VT-1 examined, and evaluated in accordance with IWB-3140 as stated in the proposed alternative.

Requiring removal of bolting as part of the corrective action when leakage occurs at a bolted connection would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee's alternative to the Code-required removal of bolting will provide reasonable assurance of the operational readiness of the bolted connection, as the integrity of the joint will be maintained. Therefore, it is recommended that the proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(ii).

C. Request for Relief ISPT-06 (Revised per letter dated 8/8/97), IWA-5242(a), Insulation Removal For VT-2 Visual Examination Of Class 1 Bolting In Borated Systems

Code Requirement: IWA-5242(a) requires that, for systems borated for the purpose of controlling reactivity, insulation shall be removed from pressure-retaining bolted connections for VT-2 visual examination.

Licensee's Proposed Alternative: Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee proposed to use the alternative contained in Code Case N-533 in lieu of the ASME Section XI requirements for removing insulation from Class 1 pressure-retaining bolted connections during VT-2 visual examinations. The licensee stated:

"The alternative test requirements of ASME Code Case N-533 will be performed for Class 1 pressure retaining bolted connections. The insulation will be removed and a VT-2 examination performed on bolted connections at each refueling outage when the systems are depressurized. This examination will be performed independent of the system pressure test. The insulation will not be removed from bolted connections during the system pressure test.

"The Code Class 1 system pressure tests will be performed at the frequency prescribed by Table IWB-2500-1, Examination Category B-P."

Licensee's Basis for the Proposed Alternative: (as stated)

"The leakage test of Code Class 1 components is performed at the completion of each refueling outage with the unit in hot standby and the reactor coolant system at full temperature and pressure. The Section XI Code Class 1 leakage test is generally the final activity prior to unit restart following the refueling outage. Compliance with the Code requirements would involve holding the unit in the hot standby mode after completion of the VT-2 examination to allow replacement of the thermal insulation and removal of scaffolding. This situation places a hardship on the plant for the following reasons:

A. Entering containment to replace thermal insulation and to remove scaffolding when the unit is at full temperature, jeopardizes the safety of personnel due to heat stress and the potential for burns resulting from contact with hot components.

B. Insulation replacement activities require holding the unit in hot standby mode until all work is completed and all personnel have exited containment. These activities will delay the return of the unit to production for several hours."

"The purpose of removing insulation from pressure retaining bolting for visual examination is to inspect for borated water leakage that could cause corrosion of the bolting. Due to the deposits of boron crystals that remain where borated water leakage occurs, it is not necessary to actually see the fluid leakage in order to determine where leakage has occurred. Therefore, borated water leakage inspections can be effectively performed when the system is depressurized. For this reason the hardships resulting from Code compliance are not commensurate with the increase in safety, or quality achieved. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that relief be granted."

Evaluation: Paragraph IWA-5242(a) requires the removal of all insulation from pressure-retaining bolted connections in systems borated for the purpose of controlling reactivity when performing VT-2 visual examinations during system pressure tests. The licensee has proposed to implement the alternative to Code requirements contained in Code Case N-533, *Alternative Requirements for VT-2 Visual Examination of Class 1 Insulated Pressure-Retaining Bolted Connections*, for Class 1 bolting in borated systems. This Code Case allows the VT-2 visual examination to be performed in conjunction with startup following a 4-hour hold time at operating pressure with the insulation in place. A VT-2 visual examination is

then performed each refueling outage during cold shutdown with the insulation removed. Use of this Code Case will significantly reduce the personnel hazards associated with the extreme heat and potential radiation exposure during the VT-2 examination with the insulation removed and subsequent replacement of the insulation prior to the run cycle.

When bolted connections are examined in accordance with Code Case N-533, the joints are VT-2 visually examined at operating pressure with the insulation in place during the start-up pressure test and again at cold shutdown during each refueling outage with the insulation removed (the system need not be pressurized for this portion of the examination). Based on this frequency of examinations, it can be concluded that the bolted joint integrity will be verified at the same frequency currently required by the Code. Significant leakage during the pressure test would be detected by the VT-2 visual examination performed with the insulation in place. If leakage occurs, corrective action would be necessary to meet minimum technical specification requirements.

Compliance with the Code requirements would require holding the unit in the hot standby mode after completion of the VT-2 examination to allow replacement of the thermal insulation and removal of scaffolding. This situation would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(ii). The licensee's alternative should be authorized for the current interval or until such time as the Code Case is published in Regulatory Gude 1.147. At that time, if the licensee intends to continue to implement this Code Case, the licensee should follow all provisions in Code Case N-533, with limitatiions issued in Regulatory Guide, 1.147, if any.

## 3.0 CONCLUSION

The INEEL staff concludes that for Relief Requests ISPT-02, ISPT-03, and ISPT-06, the licensee has demonstrated that specific Section XI requirements would result in

hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, it is recommended that, pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee's proposed alternatives be authorized. In addition, the licensee's proposed alternatives to use Code Cases N-416-1 and N-533 contained in Requests for Relief ISPT-02 and ISPT-06, respectively, should be authorized for the current interval or until such time as the Code Cases are published in Regulatory Guide 1.147. At that time, if the licensee intends to continue to implement these Code Cases, the licensee should follow all provisions in Code Cases N-416-1 and N-533, with limitations issued in Regulatory Guide 1.147, if any.