Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

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10 CFR 50.55a(a)(3)

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

Gentlemen:

In the Matter of)
Tennessee Valley Authority)

Docket No.50-390

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) SECTION XI ALTERNATE INSERVICE INSPECTION PROGRAM - RISK-INFORMED INSERVICE INSPECTION (RI-ISI) PROGRAM

Pursuant to 10 CFR 50.55a(a)(3)(i), TVA requests NRC to review and approve the WBN Unit 1 RI-ISI program. The RI-ISI program is an alternative to the current ASME Section XI Inservice Inspection requirements for Code Class 1 and 2 piping. This program was developed in accordance with the Westinghouse Owners Group Topical Report WCAP-14572, Revision 1-NP-A, "*Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report,*" dated February 1999 and WCAP-14572, Revision 1-NP-A, Supplement 1, "*Westinghouse Structural Reliability and Risk Assessment (SRRA) Model for Piping Risk-Informed Inservice Inspection,*" dated February 1999.

The enclosed WBN Unit 1 program supports the conclusion that the proposed alternative inspection provides an acceptable level of quality and safety as required by 10 CFR 50.55a(a)(3)(i). This program submittal was reviewed by the WBN Plant Operations and Review Committee on April 3, 2001.

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It should be noted that TVA considers implementation of the RI-ISI Program to be a Cost Beneficial Licensing Action. Quality of the plant is enhanced because the required inspections are specifically tailored to an identified failure mechanism. In addition, the safety of the plant is slightly improved. Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) for Unit 1 will be slightly reduced as the result of implementing the RI-ISI Program.

WBN Unit 1 is in the second period which began May 26, 1999, of the first ten-year ISI interval which ends May 26, 2006. During the second period there have been two Examination Category B-F welds examined. There have been no Examination Category B-J/C-F-1/C-F-2 welds examined during the second period. The ASME Code of Record is the 1989 Edition (no addenda) of the ASME Boiler and Pressure Vessel Code, Section XI. Additionally, in accordance with 10 CFR 50.55a(b)(2)(ii), the extent of examination for Examination Category B-J welds is in accordance with the 1974 Edition, Summer 1975 Addenda of ASME Section XI.

Enclosure 1 contains the proposed WBN Unit 1 RI-ISI program, Request for Relief, 1-RI-ISI-01, submitted as an alternative inspection program for Class 1 and 2 piping pursuant to 10 CFR 50.55a(a)(3)(i). Additional supporting documentation for the RI-ISI program is available at the WBN site for your review, if needed. TVA intends to apply the RI-ISI Program for the remainder of the first inspection interval and for the second, third, and fourth inspection intervals.

Enclosure 2 contains an additional RI-ISI Request for Relief, 1-RI-ISI-02, to utilize a VT-2 visual examination in lieu of the RI-ISI Program requirement (i.e., WCAP-14572) for performing a volumetric examination of branch connection welds less than or equal to two inches nominal pipe size and socket welds that are subject to thermal fatigue. Pursuant to 10 CFR 50.55a(a)(3)(ii), TVA is requesting relief on the basis that compliance with the requirements would result in an undue hardship to TVA without a compensating increase in the level of quality and safety.

TVA's request for relief for 1-RI-ISI-01 and 1-RI-ISI-02 is similar to the requests previously submitted for Surry Unit 2 and Turkey Point Nuclear Plants which were approved by NRC letters dated January 26, 2001, and November 30, 2000, respectively.

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TVA requests NRC's approval of the WBN Unit 1 RI-ISI program by October 2001, in order to support implementation of this program in the Unit 1 Cycle 4 refueling outage. Approval by October 2001 would allow TVA to finalize resource planning and scheduling impacts for that upcoming refueling outage or recruit additional inspectors and laborers if the program is not approved.

Code compliance is required by 10 CFR 50.55a, therefore no regulatory commitments are identified by the use of these relief requests. If you have any questions concerning this change, please contact me at (423) 365-1824.

Sincerely,

P. L. Pace
Manager, Site Licensing
and Industry Affairs

Enclosures
cc (Enclosures):

NRC Resident Inspector
Watts Bar Nuclear Plant
1260 Nuclear Plant Road
Spring City, Tennessee 37381

Mr. L. Mark Padovan, Senior Project Manager
U.S. Nuclear Regulatory Commission
MS 08G9
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852

U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth St., SW, Suite 23T85
Atlanta, Georgia 30303

ENCLOSURE 1

WATTS BAR NUCLEAR PLANT UNIT 1
REQUEST FOR RELIEF 1-RI-ISI-01
RISK INFORMED INSERVICE INSPECTION PROGRAM

Tennessee Valley Authority
Watts Bar Nuclear Plant

Request for Relief 1-RI-ISI-01

RISK-INFORMED INSERVICE INSPECTION (RI-ISI) PROGRAM SUBMITTAL

May 2001

RISK-INFORMED INSERVICE INSPECTION PROGRAM PLAN

Table of Contents

1. INTRODUCTION/RELATION TO NRC REGULATORY GUIDE RG-1.174

Introduction

Inservice inspections (ISI) are currently performed on piping to the requirements of the ASME Boiler and Pressure Vessel Code Section XI, 1989 Edition as required by 10CFR50.55a. As permitted by 10 CFR 50.55a(b)(2)(ii), Class 1 Examination Category B-J weld selection for examination are in accordance with the 1974 Edition, Summer 1975 Addenda of ASME Section XI. Per Code requirements, a different sample (%) of the total number of Class 1 welds are selected each 10-year inspection interval. Class 2 welds are scheduled per the 1989 Edition of ASME Section XI. The unit is currently in the first inspection interval as defined by the Code for Program B.

The objective of this submittal is to request a change to the ISI program plan for piping through the use of a risk-informed ISI program. The risk-informed process used in this submittal is described in Westinghouse Owners Group WCAP-14572, Revision 1-NP-A, "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report," and WCAP-14572, Revision 1-NP-A, Supplement 1, "Westinghouse Structural Reliability and Risk Assessment (SRRA) Model for Piping Risk-Informed Inservice Inspection," (referred to as "WCAP-14572, A-version" for the remainder of this document). "

As a risk-informed application, this submittal meets the intent and principles of Regulatory Guide 1.174. Further information is provided in Section 3.10 relative to defense-in-depth.

PSA Quality

The plant-specific WBN Revision 2, probabilistic safety assessment (PSA) model, was used to evaluate the consequences of pipe failures for the purposes of the RI-ISI program. The Revision 2 PSA model and supporting documentation adequately reflects the configuration of the plant design at the time of start-up. PSA personnel were involved in applying Revision 2 of the PSA model and supporting documentation to the RI-ISI evaluations and Operations personnel ensured that operational practices were consistent with the intended application. An evaluation based on the Appendix B of the EPRI PSA Applications Guide was performed to confirm that the PSA conforms to the industry guidance with respect to completeness of coverage of potential scenarios. The Revision 2 model was enhanced in order to enable the direct computation of large, early release frequency (LERF) for each set of sequences quantified. A series of sensitivity cases were run comparing the results of cut-off frequencies, unaccounted for, core damage frequency (CDF), and LERF for a range of 4 orders of magnitude in cut-off frequencies. The purpose of the sensitivity study was to establish and preserve as much sequence representation and associated CDF and LERF while at the same time optimizing the run times. Based on the results of the sensitivity studies all initiators were quantified with cut-offs set equal to 1E-12. This cut-off frequency criteria resulted in a base CDF of 4.6E-05/yr and base LERF of 1.6E-06/yr.

The WBN Individual Plant Evaluation (IPE) was submitted on September 1, 1992. The IPE was also independently reviewed by Dr. Ian Wall. WBN submitted Revision 1 to the IPE on May 2, 1994 and an NRC safety evaluation was received on October 5, 1994. Since that time, the PSA has undergone one additional revision. Revision 2 to the WBN PSA is the basis for this submittal and it was prepared for TVA by ERIN Engineering, Inc. The use of ERIN Engineering by TVA for Revision 2 also served as an independent check of the original model created by Pickard, Lowe, and Garrick,

Inc. (PLG, Inc.). Revision 2 of the PSA was used by the NRC staff during their review of the implementation of the requirements of the Maintenance Rule.

The PSA model is evaluated periodically for update. The general guidance for this activity is contained in administrative procedures. WBN is in the process of completing such an update and the Revision 3 model has just undergone a Westinghouse Owners Group (WOG) PEER review. The draft PEER review report for Revision 3 has not yet been issued. The Revision 3 update has not been released for use and was not used in this analysis.

2. PROPOSED ALTERNATIVE TO ISI PROGRAM

2.1 ASME Section XI

ASME Section XI Categories B-F, B-J, C-F-1 and C-F-2 currently contain the requirements for examining (via non-destructive examination (NDE)) piping components. This portion of the current program is limited to ASME Class 1 and Class 2 piping. The alternative risk-informed inservice inspection program for piping is described in WCAP-14572, A-version. Upon approval, the RI-ISI program will be substituted for the current examination program on ASME Class 1 and 2 piping in accordance with 10 CFR 50.55a(a)(3)(i) by alternatively providing an acceptable level of quality and safety. Other non-related portions of the ASME Section XI Code will be unaffected. WCAP-14572, A-version, provides the requirements defining the relationship between the risk-informed examination program and the remaining unaffected portions of ASME Section XI.

2.2 Augmented Programs

The augmented inspection programs remain unchanged.

3. RISK-INFORMED ISI PROCESSES

The processes used to develop the RI-ISI program are consistent with the methodology described in WCAP-14572, A-version.

The process that is being applied, involves the following steps:

- Scope Definition
- Segment Definition
- Consequence Evaluation
- Failure Assessment
- Risk Evaluation
- Expert Panel Categorization
- Element/NDE Selection
- Implement Program
- Feedback Loop

- There are no deviations to the process described in WCAP-14572, A-version.

3.1 Scope of Program

The ASME Class 1 and 2 systems included in the risk-informed ISI program are provided in Table 3.1-1.

3.2 Segment Definitions

The piping for all Class 1 and 2 systems were divided into segments.

The number of pipe segments defined for the 11 systems are summarized in Table 3.1-1. The as-operated piping and instrumentation diagrams were used to define the segments.

3.3 Consequence Evaluation

The consequences of pressure boundary failures are measured in terms of CDF and LERF. The impact on these measures due to both direct and indirect effects was considered.

3.4 Failure Assessment

Failure estimates were generated utilizing industry failure history, plant specific failure history and other relevant information.

The engineering team that performed this evaluation used the Westinghouse structural reliability and risk assessment (SRRA) software program (described in WCAP-14572, A-version) to aid in the process.

Table 3.4-1 summarizes the failure probability estimates by failure mechanism and also identifies the systems susceptible to these mechanisms.

Another consideration was whether a segment is addressed by the plant augmented programs (such as flow assisted corrosion and stress corrosion cracking). This information has been used to determine which failure probability is used in the risk-informed ISI process. The failure probabilities used in the risk-informed process are documented and maintained in the plant records.

3.5 Risk Evaluation

Each piping segment within the scope of the program was evaluated to determine its contribution to CDF and LERF due to the postulated piping failure. Calculations were also performed with and without operator action.

Once this evaluation was completed, the total pressure boundary CDF and LERF were calculated by summing across the segments for each system. The results of these calculations are presented in Table 3.5-1. The CDF due to piping failure without operator action (without ISI) is 1.50E-04/year, and with operator action (without ISI) is 8.48E-05/year. The LERF due to piping failure without operator action (without ISI) is 6.59E-06/year, and with operator action (without ISI) is 2.65E-06/year.

To assess safety significance, the risk reduction worth (RRW) and risk achievement worth (RAW) were calculated for each piping segment with and without operator action.

3.6 Expert Panel Categorization

The final safety determination (i.e., high and low safety significance) of each piping segment was made by the expert panel using both probabilistic and deterministic insights. The expert panel was comprised of personnel who have expertise in the following fields; probabilistic safety assessment, inservice examination, stress and material considerations, plant operations, and system design and operation. Members associated with the Maintenance Rule were used to ensure consistency with the other PSA applications. Alternates were used if their expertise and training were sufficient.

The expert panel had the following positions represented by either the permanent or alternate member at all times during an expert panel meeting.

- Chairman
- Design Engineering - Probabilistic Safety Assessment
- Operations
- Inservice Inspection (ISI)
- System Engineering – Representative

A minimum of 5 members or alternates filling the above positions constituted a quorum. This core team of panel members was supplemented by other experts, including a materials and stress analysis engineer and safety analysis engineer.

The chairperson conducted and ruled on the proceedings of the meeting. The chairperson appointed an alternate chairperson from the panel if he was unable to attend a meeting.

Members and alternates received training and indoctrination in the risk-informed inservice inspection selection process. They were indoctrinated in the application of risk analysis techniques for ISI. These techniques included risk importance measures, threshold values, failure probability models, failure mode assessments, PSA modeling limitations and the use of expert judgment. Training documentation is maintained with the expert panel's records.

Worksheets were provided to the panel on each system for each piping segment, containing information pertinent to the panel's selection process. This information, in conjunction with each panel member's own expertise and other documents as appropriate, were used to determine the safety significance of each piping segment.

A consensus process was used by the expert panel. Consensus is defined as unanimous during first consideration and 2/3 of members or alternates present in the second or subsequent considerations. The chairperson allowed appropriate time duration between considerations for deliberation.

The chairperson appointed someone to record the minutes of each meeting. The minutes included the names of members and alternates in attendance and verified a quorum was present. The relevant discussion summaries and the results of the voting are included in the plant documents. These minutes are available as program records.

3.7 Identification of High Safety Significant Segments

The number of high safety significant segments for each system, as determined by the expert panel, is shown in Table 5-1.

3.8 Structural Element and NDE Selection

The appropriate structural elements in the high safety significant piping segments were selected for inspection and appropriate NDE methods were defined.

The initial program being submitted addresses the high safety significant (HSS) piping components placed in regions 1 and 2 of Figure 3.7-1 in WCAP-14572, A-version. Region 3 piping components, which are low safety significant, are to be considered in an Owner Defined Program and is not considered part of the program requiring approval. Region 1, 2, 3 and 4 piping components will continue to receive Code required pressure testing, as part of the current ASME Section XI program. For the 661 piping segments that were evaluated in the RI-ISI program, Region 1 contains 78 segments, Region 2 contains 44 segments, Region 3 contains 301 segments, and Region 4 contains 238 segments.

The number of locations to be inspected in a HSS segment was determined using a Westinghouse statistical (Perdue) model as described in section 3.7 of WCAP-14572, A-version. Sixteen of the HSS piping segments in Region 1 and 40 of the HSS piping segments in Region 2 were evaluated using the Perdue model. The 66 segments that were not evaluated using the Perdue model included 62 segments containing socket welds (including branch connection welds < 2 inches nominal pipe size) and 4 additional segments containing a single butt weld, all of which are outside the applicability of the model. For these 66 segments, the guidance in Section 3.7.3 of WCAP-14572, A-version was followed.

Table 4.1-1 in WCAP-14752, A-version, was used as guidance in determining the examination requirements for the HSS piping segments. VT-2 visual examinations are scheduled in accordance with the station's pressure test program.

Additional Examinations

Since the risk-informed inspection program requires examinations on a large number of elements constructed to lesser pre-service inspection requirements, the program in all cases will determine through an engineering evaluation the root cause of any unacceptable flaw or relevant condition found during examination as described in WCAP-14572, A-version. The evaluation will include the applicable service conditions and degradation mechanisms to establish that the element(s) will still perform their intended safety function during subsequent operation. Elements not meeting this requirement will be repaired or replaced.

The evaluation will include whether other elements on the segment or segments are subject to the same root cause and degradation mechanism. Additional examinations will be performed on these elements up to a number equivalent to the number of elements required to be inspected on the segment or segments initially. If unacceptable flaws or relevant conditions are again found similar to the initial problem, the remaining elements identified as susceptible will be examined. No additional examinations will be performed if there are no additional elements identified as being susceptible to the same service related root cause conditions or degradation mechanism.

3.9 Program Relief Requests

Alternate methods are specified to ensure structural integrity in cases where examination methods cannot be applied due to limitations such as inaccessibility or radiation exposure hazard.

The intent is to provide a minimum of >90% coverage (per Code Case N-460 and NRC Information Notice 98-42) when performing the risk-informed examinations. However, some limitations will not be known until the examinations are performed since some locations will be examined for the first time due to the RI-ISI selection process.

In instances where a location may be identified at the time of the examination that the examination does not achieve >90% coverage, the process outlined in Section 4.0 of WCAP-14572, A-version, will be followed.

Currently there is no program available for qualifying single-sided Appendix VIII examinations of austenitic piping welds. Therefore, all volumetric (ultrasonic) examinations of austenitic piping welds must be examined from two sides to meet the requirements of the Rule (10CFR50.55a). Consequently, all austenitic welds selected by the RI-ISI process that are not accessible from both sides will require a request for relief because the coverage will be ≤ 90% (e.g., pipe-to-valve). The volumetric examination of ferritic piping welds may be performed from one side to obtain >90% coverage per the Rule.

All current requests for relief remain in place.

3.10 Change in Risk

The risk-informed ISI program has been prepared in accordance with Regulatory Guide 1.174, and the risk from implementation of this program is expected to slightly decrease when compared to that estimated from current requirements.

A comparison between the proposed RI-ISI program and the current ASME Section XI ISI program was made to evaluate the change in risk. The approach evaluated the change in risk with the inclusion of the probability of detection as determined by the SRRA model. This evaluation resulted in the identification of 15 additional piping segments for which examinations are now required.

The results from the risk comparison are shown in Table 3.10-1. As seen from the table, the RI-ISI program reduces the risk associated with piping CDF/LERF slightly more than the current Section XI program while reducing the number of examinations. Table 3.10-1 also includes the systems that are the main contributors to the risk reduction in moving from the current program to the RI-ISI program. The primary basis for this risk reduction is that examinations are now being placed on piping segments that are high safety significant and which are not inspected by NDE in the current ASME Section XI ISI Program.

Defense-In-Depth

As the reactor coolant piping serves as a fission product barrier, the reactor coolant piping will continue to receive a system pressure test and visual VT-2 examination as currently required by the Code. Volumetric examinations are proposed on the smaller reactor coolant piping as part of the RI-ISI program. The larger diameter reactor coolant loop piping was not selected in the RI-ISI process. However, the larger reactor coolant loop piping segments are retained in the program for "defense-in-depth" considerations. The locations selected were associated with the reactor vessel dissimilar metal welds on the hot and cold legs (a total of 8 welds are added). These locations were identified as being the area to inspect in the RI-ISI process.

4. IMPLEMENTATION AND MONITORING PROGRAM

Upon approval of the RI-ISI program, procedures that comply with the guidelines described in WCAP-14572, A-version, will be prepared to implement and monitor the program. The new program will be integrated into the existing ASME Section XI interval.

The final safety analysis report (FSAR) contains information on the current ASME Section XI ISI program. No changes to the FSAR are necessary for program implementation.

The applicable aspects of the Code not affected by this change would be retained, such as inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements. Existing ASME Section XI program implementing procedures would be retained and would be modified to address the RI-ISI process, as appropriate.

The proposed monitoring and corrective action program contains the following elements:

A. Identify
B. Characterize
C. (1) Evaluate, determine the cause and extent of the condition identified
   (2) Evaluate, develop a corrective action plan or plans
D. Decide
E. Implement
F. Monitor
G. Trend

The RI-ISI program is a living program requiring feedback of new relevant information to ensure the appropriate identification of high safety significant piping locations. As a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME period basis. Significant changes may require more frequent adjustment as recommended by an NRC Bulletin or Generic Letter, or by plant specific feedback.

5. PROPOSED ISI PROGRAM PLAN CHANGE

A comparison between the RI-ISI program and the current ASME Section XI program requirements for piping is given in Table 5-1. An identification of piping segments that are part of plant augmented programs is also included in Table 5-1.

The plant will be performing examinations on elements not currently required to be examined by ASME Section XI. An example of these additional examinations is provided below.

- The ASME Section XI Code does not require volumetric or surface examinations of piping less than 3/8 inch wall thickness on Class 2 piping greater than 4 inch nominal pipe size (NPS). The welds are counted for percentage requirements, but not examined by NDE. The RI-ISI program will require examination of these welds. Examples where the risk informed process required examination and the Code did not are the suction lines to the charging pumps (high head safety injection).

The initial program will be started in the inspection period current at the time of program approval. For example the second inspection period of the first inspection interval for Unit 1 ends on May 26, 2003. If the program is approved such that a refueling outage remains in the second period, at least 66% of the inspection interval required examinations will be performed by the end of the first inspection interval per the risk-informed inspection program.

6.0 REFERENCES/DOCUMENTATION

WCAP-14572, Revision 1-NP-A, , "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report," February 1999

WCAP-14572, Revision 1-NP-A, Supplement 1, "Westinghouse Structural Reliability and Risk Assessment (SRRA) Model for Piping Risk-Informed Inservice inspection," February 1999

Supporting Onsite Documentation

Watts Bar Nuclear Plant Unit 1 Risk Informed Inservice Inspection (RI-ISI) Program Scope, Revision 1, April 19, 2000

WBN-MEB-MDN1999-000049, Revision 0, "RI-ISI Piping Segment/Direct Consequence Definition."

WBN-MEB-MDQ1999-990026, Revision 0, "TVA RI-ISI Piping Indirect Consequence Evaluation for Watts Bar Unit 1."

WBN-MEB-MDN1999-990043, Revision 0, "RI-ISI PSA Consequence Evaluation."

WCG-1-1888, Revision 1, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Auxiliary Feedwater System."

WCG-1-1889, Revision 1, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Steam Generator Blowdown System."

WCG-1-1898, Revision 1, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Chemical and Volume Control and Flood Mode Boration System."

WCG-1-1891, Revision 0, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Containment Isolation System."

WCG-1-1903, Revision 1, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Containment Spray System."

WCG-1-1887, Revision 1, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Feedwater and Steam Generator Wet Layup Systems."

WCG-1-1885, Revision 1, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Main Steam System."

WCG-1-1901, Revision 1, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Reactor Coolant System."

WCG-1-1904, Revision 1, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Residual Heat Removal System."

WCG-1-1899, Revision 2, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Safety Injection System."

WCG-1-1894, Revision 0, "RI-ISI Structural Reliability and Risk Assessment (SRRA) of the Water Quality and Sampling System."

Westinghouse Calculation Note, CN-RRA-00-37 Revision 1, "TVA RI-ISI Risk Evaluation for Watts Bar."

Westinghouse Calculation Note, CN-RRA-00-58, Revision 0, "TVA RI-ISI Expert Panel and RI-ISI Database for Watts Bar."

Westinghouse Calculation Note, CN-RRA-00-61, Revision 0 "TVA RI-ISI Perdue Model Calculation for Watts Bar Unit 1."

Westinghouse Calculation Note, CN-RRA-00-59, Revision 0, "TVA RI-ISI Delta Risk Evaluation for Watts Bar Unit 1."

Table 3.1-1
Watts Bar Nuclear Plant Unit 1
System Selection and Segment Definition

System Description	PSA	Section XI	Number of Segments
AF-Auxiliary Feedwater	Yes	Yes	23
BD-Steam Generator Blowdown	Yes	Yes[1]	33
CH-Chemical & Volume Control	Yes	Yes	109
CI-Containment Isolation[2]	Yes[3]	Yes[5]	116
CS-Containment Spray	Yes	Yes	25
FW-Main Feedwater[4]	Yes	Yes	71
MS-Main Steam	Yes	Yes	13
RC-Reactor Coolant	Yes	Yes	124
RH-Residual Heat Removal	Yes	Yes	26
SI-Safety Injection	Yes	Yes	115
SQ-Sample & Water Quality	No	Yes[1]	6
Total			661

Notes:
1. System is exempt from current ASME Section XI pipe weld examination requirements (volumetric, surface).
2. Includes containment isolation piping only. Other portions of these systems are not Class 1 or 2 and are not within the scope of this program. The systems included are: Air Conditioning, Component Cooling Water, Control Air/Auxiliary Control Air, Demineralized Water & Cask Decon, Essential Raw Cooling Water, High Pressure Fire Protection, Ice Condenser, Primary Makeup Water, Radiation Monitoring, Service Air, Spent Fuel Pit Cooling, Ventilation, & Waste Disposal. Containment isolation piping for the other systems within scope of this program are included with the system.
3. Portions of this system are not part of the PSA.
4. Includes a portion of the Layup Water Treatment System
5. System is exempt from current ASME Section XI pipe weld examination program requirements (volumetric, surface) or is not within the scope of the current ASME Section XI NDE program.

Table 3.4-1
Watts Bar
Failure Probability Estimates (without ISI)

Failure Mechanism	Failure Probability Range (Small Leak Probability @ 40 years, no ISI)	Susceptible Systems
Thermal Fatigue	1.40E-09 to 2.11E-03	AF, BD, CH, CI, CS, FW, MS, RC, RH, SI, SQ
Thermal Fatigue, Striping/Stratification	6.97E-05 to 1.03E-02	AF, CH, RC, RH, SI
Erosion/Corrosion/Wastage	4.41E-02 to 6.16E-01	AF, BD, CI, FW
Thermal and Vibratory Fatigue	2.74E-07 to 1.19E-02	BD, CH, CS, FW, MS, RC, RH, SI
Stress Corrosion Cracking	8.48E-04 to 1.55E-01	RC, RH, SI

Table 3.5-1

Watts Bar

Number of Segments and Mean Piping Risk Contribution by System (without ISI)

System	Number of Segments	Case			
		CDF Without Operator Action	CDF With Operator Action	LERF Without Operator Action	LERF With Operator Action
AF	23	3.75E-06	2.64E-07	3.46E-07	2.26E-08
BD	33	2.19E-06	2.19E-06	2.07E-07	2.07E-07
CH	109	7.21E-05	1.35E-05	3.73E-06	2.99E-07
CI	116	1.16E-08	9.81E-09	2.07E-10	2.00E-10
CS	25	1.10E-06	2.67E-09	6.31E-08	2.57E-10
FW	71	9.59E-07	9.37E-07	2.50E-07	2.40E-07
MS	13	6.17E-08	6.17E-08	1.39E-08	1.39E-08
RC	124	1.35E-05	1.33E-05	3.77E-07	3.68E-07
RH	26	1.13E-06	1.89E-07	6.39E-08	4.82E-09
SI	115	5.54E-05	5.43E-05	1.54E-06	1.49E-06
SQ	6	1.36E-07	1.36E-07	3.28E-09	3.28E-09
Total	661	1.50E-04	8.48E-05	6.59E-06	2.65E-06

Table 3.10-1 Watts Bar Comparison Of CDF/LERF For Current Section XI And Risk-Informed ISI Programs And The Systems Which Contributed Significantly To The Change		
Case (Systems Contributing to Change)	Piping CDF/LERF Current Section XI	Piping CDF/LERF Risk-Informed
CDF No Operator Action (BD, CH, RC, SI)	1.06E-04	1.02E-04
CDF with Operator Action (BD, CH, RC, SI)	4.86E-05	4.60E-05
LERF No Operator Action (AF, BD, CH, RC, SI)	5.02E-06	4.74E-06
LERF With Operator Action (AF, BD, CH, RC, SI)	1.57E-06	1.43E-06

Table 5-1
Watts Bar Nuclear Plant Unit 1
STRUCTURAL ELEMENT SELECTION
RESULTS AND COMPARISON TO ASME SECTION XI
1989 EDITION REQUIREMENTS

System	Number of High Safety-Significant Segments (No. in Augmented Program[2])	RI-ISI Program High Safety-Significant Structural Elements[1]		ASME Section XI ISI Program 1989 Edition Examination Category Weld Selections[10]				Total Number of Segments Credited in Augmented Programs
		Class 1	Class 2	B-F	B-J	C-F-1	C-F-2	
AF[9]	4 (4[5])	-	4+4[8]	-	-	-	11	12[5]
BD[9]	12 (8[5])	-	8+4[3]+4[4]	-	-	-	-	8[5]
CH	13 (0)	7+8[3]	2[6]+1[3,8]	-	41	53	-	0
CI	0	-	-	-	-	-	-	0
CS	1 (0)	-	1+1[4]+2[8]	-	-	21	-	0
FW[9]	12 (0)	-	8[3]+4[6]+5[8]	-	-	-	13	26[5]
MS	0	-	-	-	-	-	12	0
RC	22 (1)	11+8[7]+9[3]	-	22	74	-	-	1
RH	5 (1)	3	3+1[4]+3[8]	-	8	26	-	1
SI	53 (1)	15+15[3]+4[4]	13+17[3]+3[4]	-	120	69	-	3
SQ	0	-	-	-	-	-	-	0
Total	122	80	88	22	243	169	36	51

Summary: Current ASME Section XI selects a total of 470 weld locations for non-destructive examination while the proposed RI-ISI program selects a total of 87 exam locations (168-81 visual exam locations), which results in a 81% reduction.

Notes:

1. ASME Section XI system pressure tests and VT-2 visual examinations shall continue to be performed for all ASME Code Class 1 and 2 systems.
2. All augmented programs continue.
3. VT-2 examination for entire segment (see Request for Relief 1-RI-ISI-02).
4. VT-2 examination for a portion of the segment (see Request for Relief 1-RI-ISI-02).
5. UT thickness only.
6. VT-2 examination for entire segment.
7. Eight examination locations added for defense-in-depth at the reactor vessel nozzle to safe-end pipe welds.
8. Fifteen examination locations added for change in risk considerations.
9. Augmented programs for erosion-corrosion continue.
10. Weld selection numbers are based on plant procedure 1-TRI-0-10, Revision 6, ASME Section XI ISI/NDE Program."

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT UNIT 1
REQUEST FOR RELIEF 1-RI-ISI-02
SOCKET WELDS

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
REQUEST FOR RELIEF 1-RI-ISI-02

EXECUTIVE SUMMARY:

TVA has developed a Risk-Informed Inservice Inspection (RI-ISI) Program for Class 1 and 2 piping for WBN in accordance with the provisions of WCAP-14572, Revision 1-NP-A. Table 4.1-1 of the WCAP requires that high safety significant (HSS) piping segments which are subject to thermal fatigue and that have been selected for examination be volumetrically examined. The requirements contained in Table 4.1-1 have been taken directly from Code Case N-577, Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method A.

Certain HSS segments, or portions of HSS segments, at WBN have been identified as subject to thermal fatigue. These segments have been identified with a potential thermal fatigue damage mechanism either caused by a postulated temperature stratification or as a default mechanism for segments selected for their consequence of failure with no active or postulated mechanism occurring. Some of these segments which are subject to thermal fatigue contain branch connection welds $\leq$ 2 inches nominal pipe size and/or socket welds. Performance of a volumetric examination of branch connection welds $\leq$ 2 inches nominal pipe size (NPS) and/or socket welds will not result in an examination which achieves meaningful results due to the size and geometric configuration of the weld joint. Performance of surface examinations from the outside diameter (OD) would not provide additional information for inside diameter (ID) initiated flaws.

TVA has taken protective measures to mitigate OD initiated or OD postulated failures. These measures include control of purchase of piping and components, control of welding processes, surface cleanness specifications, and utilizing insulation to reduce temperature differentials.

Code Case N-577 has been revised to allow a VT-2 examination of socket welds for all failure mechanisms. Performance of a VT-2 examination of branch connection welds $\leq$ 2 inches NPS and/or socket welds is the most reasonable alternative examination to the required volumetric examination. The required volumetric examination would result in unusual difficulty without a compensating increase in the level of quality and safety.

Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is requested that relief be granted.

UNITS: WBN Unit 1

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
REQUEST FOR RELIEF 1-RI-ISI-02

SYSTEM: Various

ASME CODE CLASS: 1 and 2

ASME SECTION XI CODE EDITION/ADDENDA: 1989 Edition of ASME Section XI
and WCAP-14572, Revision 1-NP-A

CODE TABLE: Table 4.1-1 of WCAP-14572, Revision 1-NP-A

EXAMINATION CATEGORY: R-A, RISK-INFORMED PIPING EXAMINATIONS

EXAMINATION ITEM NUMBER: R1.11, High Safety Significant Piping Structural Elements Subject to Thermal Fatigue

REQUIREMENTS:

Table 4.1-1, Examination Category R-A, Item Number R1.11, requires elements in HSS segments which are subject to thermal fatigue and that have been selected for examination be volumetrically examined.

REQUIREMENT FROM WHICH RELIEF IS REQUESTED:

Relief is requested from performing a volumetric examination of branch connection welds $\leq$ 2 inches NPS and socket welds that are subject to thermal fatigue.

BASIS FOR RELIEF:

The design joint configuration and size of branch connection welds that are $\leq$ 2 inches NPS and socket welds prohibits the performance of a volumetric examination which achieves meaningful results. The performance of a VT-2 examination during a system pressure test provides reasonable assurance of continued structural integrity.

JUSTIFICATION FOR THE GRANTING OF RELIEF:

Table 4.1-1, Examination Category R-A, of WCAP-14572, Revision 1-NP-A provides information for the examination of structural elements (welds or base material for failure mechanisms such as FAC) in piping segments which have been identified as HSS. The requirements contained in Table 4.1-1 have been taken directly from Code Case N-577, Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method A. Piping welds within a HSS segment are selected for examination, and examination methods are determined based on active or postulated failure mechanisms as identified in

Table 4.1-1. Piping welds subject to thermal fatigue and that are selected for examination are required to be volumetrically examined in accordance with Item Number R1.11 of Examination Category R-A.

Certain HSS piping segments at WBN have been identified as being subject to thermal fatigue, and therefore, require volumetric examination. Some of these segments include branch connection welds which are ≤ 2 inches NPS and/or socket welds. These segments have been identified with a potential thermal fatigue damage mechanism either caused by a postulated temperature stratification or as a default mechanism for segments selected for their consequence of failure with no active or postulated mechanism occurring. The requirement to perform a volumetric examination on branch connection weld ≤ 2 inches NPS or socket weld does not consider the size and geometric limitations imposed by these types of welds. Performance of a volumetric examination on branch connection welds ≤ 2 inches NPS or socket welds will not result in an examination which achieves meaningful results. Performance of surface examinations from the OD would not provide additional information for ID initiated flaws such as thermal stratification.

TVA has taken protective measures to mitigate OD initiated or OD postulated failures. These failures include but are not limited to transgranular stress corrosion cracking, halogen-induced stress corrosion cracking, OD initiated fatigue mechanisms, and intergranular stress corrosion cracking. Austenitic stainless steel and nickel based alloys piping and components are purchased to ASTM/ASME requirements which ensures that no sensitized/improperly heat treated parts are bought or issued for installation. These requirements are covered by the TVA's General Engineering Specification for these materials. In addition, TVA's welding program requirements ensure that proper measures are taken prior to welding. The purchase of filler metals and related materials (e.g., insulation, temperature indicating materials, etc.) are controlled such that limited amounts of detrimental halides are introduced to the weldments. The welding procedures utilized by TVA are controlled to prevent undue sensitization of the heat-affected zones of the weldments. Surface cleanness is addressed in the WBN Updated Final Safety Analysis Report (UFSAR), Section 5.2.5, and by TVA's General Engineering Specification for material and related site implementing documents. These requirements ensure that the external surface is left in a condition where detrimental halides are minimized to reduce the possibility of cracking such as chloride stress corrosion cracking. Temperature differentials are reduced by applying insulation where applicable and the appropriate supports when necessary. This reduces the

possibility of temperature fluctuations which could lead to OD initiated thermal fatigue.

The ASME Code Committee has revised and published Code Case N-577 to allow a
VT-2 examination of socket welds for all failure mechanisms. The revised code case is identified as N-577-1. Code Case N-577-1 allows the performance of the VT-2 examination of socket welds in note 12 of Table 1. It is understood that NRC has not yet published results of a review of Code Case N-577-1.

Performance of a volumetric examination of branch connection welds ≤ 2 inches NPS and/or socket welds will not result in an examination which achieves meaningful results due to the size and geometric configuration of the weld joint. The required volumetric examination would result in unusual difficulty without a compensating increase in the level of quality and safety. Performance of a VT-2 examination of branch connection welds ≤ 2 inches NPS and/or socket welds in HSS segments, or portions of HSS segments, is the most reasonable alternative examination to the required volumetric examination.

Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is requested that relief be granted.

ALTERNATIVE EXAMINATION (S):

Branch connection welds ≤ 2 inches NPS and socket welds in HSS segments subject to thermal fatigue will be VT-2 examined each refueling outage during a system pressure test or a pressure test specific to a component/element. Butt welds selected for examination will be volumetrically examined.

IMPLEMENTATION SCHEDULE:

This request for relief will be implemented after NRC approval of the WBN RI-ISI program submittal and this request for relief.