

January 24, 2002

Mr. J. A. Scalice  
Chief Nuclear Officer and  
Executive Vice President  
Tennessee Valley Authority  
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SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1, RELIEF REQUEST — AMERICAN SOCIETY OF MECHANICAL ENGINEERS, SECTION XI, ALTERNATE INSERVICE INSPECTION PROGRAM — RISK-INFORMED INSERVICE INSPECTION PROGRAM (TAC NO. MB2082)

Dear Mr. Scalice:

Tennessee Valley Authority's (TVA's) letter of May 21, 2001, as supplemented on September 28, 2001, requested approval of a risk-informed inservice inspection (RI-ISI) program for Class 1 and Class 2 piping welds as an alternative to the current ISI program at Watts Bar Unit 1. TVA developed the proposed RI-ISI program in accordance with Westinghouse Owners Group Topical Report WCAP-14572, Revision 1-NP-A. The U.S. Nuclear Regulatory Commission (NRC) concludes that the proposed RI-ISI program is an acceptable alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (the Code), Section XI, for inservice inspection of Code Class 1 piping, Categories B-F and B-J welds, and Class 2 piping, Categories C-F-1 and C-F-2 welds. Therefore, TVA's Request for Relief 1-RI-ISI-01 is authorized pursuant to Title 10, *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i) for the first 10-year ISI interval on the basis that the alternative provides an acceptable level of quality and safety.

In addition, TVA submitted Request for Relief 1-RI-ISI-02 for Watts Bar Unit 1 to the NRC. This relief would permit TVA to perform visual VT-2 examinations each refueling outage as an alternative to certain volumetric examinations specified in Code Case N-577 and in WCAP-14572, Revision 1-NP-A. The visual examination alternative would apply to high safety-significant branch connection welds less than or equal to 2 inches nominal pipe size and socket welds identified in the RI-ISI program. The NRC staff concurs that volumetric examination of these welds is inconclusive and impractical due to the geometric limitations imposed by branch connection welds less than or equal to 2 inches nominal pipe size and socket welds. The staff also concurs that it is not necessary for TVA to perform the Code-required surface examination of these welds in the absence of an environment which would cause outside surface-initiated flaws. Therefore, TVA's proposed alternative examination method is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that performing either the volumetric or the surface examinations of the branch connection welds less than or equal to 2 inches nominal pipe size and socket welds would result in unusual difficulty without a compensating increase in the level of quality and safety.

J. A. Scalice

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A copy of our safety evaluation is enclosed. The NRC authorizes TVA to apply Relief Requests 1-RI-ISI-01 and 1-RI-ISI-02 during the first 10-year ISI interval of Watts Bar Unit 1.

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

J. A. Scalice

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RISK-INFORMED INSERVICE INSPECTION PROGRAM

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-390

1.0 INTRODUCTION

For Watts Bar Nuclear Plant, Unit 1 (WBN), the applicable edition of the Code for the first 10-year inservice inspection (ISI) interval is the 1989 Edition of American Society of Mechanical Engineers (ASME) Section XI. Reference 1 states that in accordance with Title 10, *Code of Federal Regulations* (10 CFR), Section 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. In a submittal to the U.S. Nuclear Regulatory Commission (NRC or the Commission) dated May 21, 2001, as supplemented on September 28, 2001 (Refs. 1 and 2), the Tennessee Valley Authority (TVA) proposed a risk-informed inservice inspection (RI-ISI) program as an alternative to a portion of its current ISI program for WBN.

The RI-ISI program at WBN is limited to ASME Code Class 1 and Class 2 piping. TVA developed the program in accordance with the methodology contained in the Westinghouse Owners Group (WOG) Topical Report, WCAP-14572, Revision 1-NP-A (Ref. 3), which the NRC staff previously reviewed and approved.

In the proposed RI-ISI program, TVA determined piping failure potential estimates using WCAP-14572, Revision 1-NP-A, Supplement 1, "Westinghouse Structural Reliability and Risk Assessment (SRRA)" Code. This Code uses industry piping failure history, plant-specific piping failure history, and other relevant information. TVA ranked piping segments according to safety to determine new inspection locations using the failure potential and supporting insights on piping failure consequences from TVA's probabilistic risk assessment (PRA). The proposed program maintains the fundamental requirements of ASME Code, Section XI, such as the examination technology, examination frequency and acceptance criteria. However, the proposed program reduces the required examination locations, but TVA indicates that an acceptable level of quality and safety is maintained. Thus, the proposed alternative approach is based on TVA providing an acceptable level of quality and safety in accordance with 10 CFR 50.55a(a)(3)(i).

In addition, TVA submitted Request for Relief 1-RI-ISI-02 for WBN to perform certain visual VT-2 examinations each refueling outage as an alternative to the volumetric examinations specified in Code Case N-577 and in WCAP-14572, Revision 1-NP-A. The VT-2 examinations pertain to

Enclosure

those high safety-significant branch connection welds less than or equal to 2 inches nominal pipe size and socket welds identified in the RI-ISI program. The NRC staff reviewed this relief request pursuant to 10 CFR 50.55a(a)(3)(ii) for the first 10-year ISI interval.

## 2.0 SUMMARY OF PROPOSED APPROACH

The ASME Code, Section XI, requires that for each successive 10-year ISI interval, 100 percent of Category B-F welds and 25 percent of Category B-J welds for ASME Code Class 1 piping greater than 1 inch in nominal diameter be selected for volumetric and/or surface examination based on existing stress analyses and cumulative usage factors. For Category C-F piping welds, 7.5 percent of non-exempt welds shall be selected for volumetric and/or surface examination.

The licensee's application is an RI-ISI "template" application. Template applications are short overview submittals intended to expedite preparation and review of RI-ISI submittals that comply with a pre-approved methodology. The licensee proposed to implement the staff-approved RI-ISI methodology delineated in WCAP-14572, Revision 1-NP-A.

TVA also indicated that all existing relief requests remain applicable as they are addressed in its safety evaluation reports. WBN is currently in the second period which began on May 26, 1999, of the first 10-year ISI interval which ends on May 26, 2006. The licensee plans to implement the RI-ISI program by performing the examinations required under the program during the planned outages of the second inspection period of the first 10-year ISI interval. Other non-related portions of the Code requirements, as well as the ongoing augmented inspection program at WBN will remain unchanged.

The implementation of an RI-ISI program for piping should begin at the start of a 10-year inservice inspection interval consistent with the requirements of the ASME, Code and Addenda committed to by the licensee in accordance with 10 CFR 50.55a. However, the implementation may begin at any point in an existing interval as long as the examinations are scheduled and distributed consistent with the ASME Code requirements (e.g., the minimum examinations completed at the end of the three inspection intervals under ASME Code Program B should be 16 percent, 50 percent, and 100 percent, respectively, and the maximum examinations credited at the end of the respective periods should be 34 percent, 67 percent, and 100 percent).

It is also the staff's view that the inspections for the RI-ISI program and for the balance of the ISI program should be on the same interval start and end dates. This can be accomplished by either starting the RI-ISI program at the beginning of the interval or merging the RI-ISI program into the ISI program for the balance of the inspections if the RI-ISI program is to begin during an existing ISI interval. One reason for this view is that it eliminates the problem of having different Codes of record for the RI-ISI program and for the balance of the ISI program. A potential problem with using two different interval start dates and hence two different Codes of record would be having two sets of repair/replacement rules depending upon which program identified the need for repair (e.g., a weld inspection versus a pressure test). In Reference 1, TVA stated that they will integrate the RI-ISI program into the existing ASME, Section XI, interval. TVA also stated that they will start the initial program in the inspection period current at the time of program approval, and that WBN will schedule and credit examinations consistent with ASME, Section XI, minimum requirements.

The staff finds that the WBN Unit 1 RI-ISI program meets the ASME Code and 10 CFR 50.55a requirements for minimum and maximum inspections during inspection periods and intervals and for program submittal to the NRC.

### 3.0 EVALUATION

The licensee's submittal was reviewed with respect to the methodology and criteria contained in WCAP-14572, Revision 1-NP-A . Further guidance in defining acceptable methods for implementing an RI-ISI program is also provided in Regulatory Guide (RG) 1.174, RG 1.178, and Standard Review Plan (SRP) Chapter 3.9.8 (Refs. 4, 5, and 6).

#### 3.1 Proposed Changes to the ISI Program

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee has proposed to implement the RI-ISI methodology described in WCAP-14572, Revision 1-NP-A , as an alternative to the Code examination requirements for ASME Class 1 and 2 piping for WBN. TVA provided a general description of the proposed changes to the ISI program in Section 3 of its submittal.

#### 3.2 Engineering Analysis

In accordance with the guidance provided in RGs 1.174 and 1.178, an engineering analysis of the proposed changes is required using a combination of traditional engineering analysis and supporting insights from the PRA. The licensee explained how its engineering analyses conducted for the WBN RI-ISI program ensures that the proposed changes are consistent with the principles of defense-in-depth. This is accomplished by evaluating a location's susceptibility to a particular degradation mechanism and then performing an independent assessment of the consequence of a failure at that location. The RI-ISI process does not make changes to the evaluation of design basis accidents in WBN's final safety analysis report. Therefore, sufficient safety margins will be maintained.

The licensee's RI-ISI program at WBN applies to ASME Class 1 Categories B-F and B-J and ASME Class 2 Categories C-F-1 and C-F-2 piping welds. TVA stated in its submittal that this program will not affect other non-related portions of the ASME, Section XI, Code ISI program. Piping systems defined by the scope of the RI-ISI program were divided into piping segments. Pipe segments are defined as lengths of pipe whose failure leads to the same consequence, are separated by flow splits and locations of pipe size changes, and include piping to a point at which a pipe break could be isolated.

TVA also submitted Request for Relief 1-RI-ISI-02 for WBN to perform certain visual VT-2 examinations each refueling outage as an alternative to the volumetric examinations specified in Code Case N-577 and in WCAP-14572, Revision 1-NP-A. The VT-2 examinations pertain to those high safety-significant branch connection welds less than or equal to 2 inches nominal pipe size and socket welds identified in the RI-ISI program. The licensee indicated that Code Case N-577 has been revised to allow substituting the VT-2 examination method on socket welds selected as being high safety-significant (HSS). This request is reasonable because the volumetric examination of these welds is inconclusive and impractical due to the geometric limitations imposed by branch connection welds less than or equal to 2 inches nominal pipe size and socket welds. However, the staff notes that Table IWB-2500-1 of the Code requires surface examination, not volumetric examination, at the socket welds. Surface examination

(i.e., liquid penetration examination) is an effective method for discovery of potential surface flaws on the outside surface, and specifically, flaws induced by low-cycle, high-bending stress thermal fatigue or by external chloride stress corrosion cracking (ECSCC).

The licensee stated in Reference 1 that it has taken protective measures to mitigate outside diameter (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. TVA purchases austenitic stainless steel and nickel-based alloys piping and components to American Society for Testing and Materials/ASME requirements, which ensures that no sensitized/improperly heat treated parts are bought or issued for installation. TVA's General Engineering Specification covers these requirements for these materials. In addition, TVA's welding program requirements ensure that proper measures are taken prior to welding. The licensee further stated that the welding procedures TVA uses are controlled to prevent undue sensitization of the heat-affected zones of the weldments. WBN's Updated Final Safety Analysis Report, TVA's General Engineering Specification for these materials, and related site implementing documents address surface cleanliness. These requirements ensure that the external surface is maintained in a condition which reduces the possibility of cracking such as ECSCC. The licensee also indicated that its procedures ensure that temperature differentials are reduced by applying insulation where applicable, and appropriate supports are installed when necessary. This reduces the possibility of temperature fluctuations which could lead to OD-initiated thermal fatigue. Based on these protective measures, the staff concludes that conditions do not exist in the Code Class piping at WBN that warrant surface examination of branch connection welds less than or equal to 2 inches nominal pipe size and socket welds. Hence, the staff concludes that performing a VT-2 visual examination is sufficiently effective and, therefore, acceptable. The staff notes that the revised Code Case N-577 has neither been issued nor been reviewed and approved by the NRC. Thus, the approval of this request is based on the technical soundness of applying VT-2 visual examination to specific conditions at WBN Unit 1, and should not be considered as an endorsement of the Code Case. Therefore, TVA's proposed alternative examination method is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that performing either the volumetric or the surface examinations of the branch connection welds less than or equal to 2 inches nominal pipe size and socket welds would result in unusual difficulty without a compensating increase in the level of quality and safety.

The NRC staff reviewed the proposed RI-ISI program against the guidelines contained in the previously approved WCAP-14572, Revision 1-NP-A, which states, in part, that the SRRA computer models are to be used to estimate the failure probabilities of the structural elements in each of the piping segments. In Reference 2, TVA states that the failure probabilities for WBN piping segments were all derived using the SRRA software program. This is consistent with the guidelines in previously approved WCAP-14572, Revision 1-NP-A. The degradation mechanisms identified in the submittal include thermal fatigue, thermal striping/stratification, erosion/corrosion/wastage, thermal and vibratory fatigue, and stress corrosion cracking.

The staff reviewed the qualifications, experience, and training of the users of the SRRA code on the capabilities and limitations of the code described in Reference 2 and find them to be adequate. The licensee stated in Reference 2 that the effects of ISI of existing augmented programs are included to categorize the segments as described in the approved WCAP-14572, Revision 1-NP-A. TVA stated in Reference 2 that when they use the SRRA code to calculate failure probabilities for flow accelerated corrosion (FAC), they coordinate data used with the



existing plant program. The FAC program representative obtained the wall thinning rates from the plant personnel responsible for the ongoing monitoring programs and the information provided was documented in the SRRA calculations. The licensee further stated in Reference 2 that they applied the SRRA code to standard piping geometry. Also, TVA only used the code to calculate failure probabilities for the failure modes, materials, degradation mechanisms, input variables, and uncertainties it was programmed to consider as discussed in the WCAP-14572, Supplement 1. The staff reviewed the sensitivity studies performed to support the use of the SRRA code as described in Reference 2 and find them to be adequate.

The licensee reported a deviation in the WCAP-14572, Revision 1-NP-A methodology regarding taking credit for leak detection when calculating pipe failure probabilities. WCAP-14572, Revision 1-NP-A, allows credit for detecting (and isolating, repairing, or otherwise terminating a potential accident sequence) a leak in the reactor coolant system (RCS) piping before it develops into a pipe break for piping inside of the containment. This credit reflects the highly developed leak detection systems used to monitor leakage from the reactor coolant piping. In Reference 2, the licensee states that detecting a leak-before-break is plausible to any non-RCS segment located inside the containment that interfaces with the RCS. This is accomplished by using radiation and sump level monitors that can detect a leak in the non-RCS segment as reliably as that of an RCS leak. Extending credit for leak detection in these segments is reasonable and acceptable because the segments are subject to essentially the same leak detection capabilities as that of an RCS leak.

TVA stated that they evaluated and ranked the consequences of pressure boundary failure based on the impact on core damage probability and large early-release probability. Both direct and indirect effects of pipe ruptures were evaluated and included in the consequence characterization. The licensee did not report any deviations from the consequence characterization methodology in WCAP-14572, Revision 1-NP-A, and, therefore, its analyses are acceptable.

### 3.3 Probabilistic Risk Assessment

TVA submitted the WBN Individual Plant Examination (IPE) to the staff on September 1, 1992. Revision 1 of the IPE was submitted to the staff on May 2, 1994. The staff evaluation report of October 5, 1994, noted no weakness in the analysis or methods, but identified the licensee's intention not to further update the PRA to reflect the plant at start-up as a deficiency. WBN received its operating license and began power operation in 1996. TVA subsequently updated the PRA and stated that Revision 2 of the PRA model reflected the plant configuration at start-up. Operations personnel helped develop the Revision 2 update to ensure that operational practices were appropriately modeled in the PRA and support the RI-ISI submittal. Reference 1 gives estimates of core damage frequency (CDF) and large early release frequency (LERF) of  $4.6E-5/\text{yr}$  and  $1.6E-6/\text{yr}$ , respectively. The licensee stated that they periodically evaluate the PRA for updating. TVA issued Revision 3 of the PRA and it underwent a WOG peer review shortly before TVA submitted its RI-ISI relief request. Revision 3 of the PRA, or a later version, will be used during the review of the risk ranking of segments during the next RI-ISI periodic update. The staff finds that the use of the Revision 2 PRA reflecting the operating plant at the time the RI-ISI submittal was initiated is reasonable and acceptable.

The staff did not review the PRA analysis to assess the accuracy of the quantitative estimates. Quantitative results of the PRA are used, in combination with a quantitative characterization of

the pipe segment failure likelihood, to support the assignment of segments into broad safety significance categories reflecting the relative importance of pipe segment failures on CDF and LERF. Inaccuracies in the models or assumptions that are large enough to invalidate the broad categorizations developed to support the RI-ISI should have been identified in the licensee's or in the staff's review. Minor errors or inappropriate assumptions will only affect the consequence categorization of a few segments and will not invalidate the general results or conclusions. The continuous use and maintenance of the PRA provides further opportunities to identify inaccuracies and inappropriate assumptions, if any, in the PRA models. The staff finds that the quality of the PRA is sufficient to support the submittal.

The licensee stated in Reference 2 that the risk ranking and change in risk calculations were performed according to the guidance provided in Section 4.4.2 of WCAP-14572, Revision 1-NP-A, aside from the one deviation discussed in Section 3.2 of this safety evaluation. The change in CDF is estimated to be about  $-2.6E-6/\text{yr}$  with and  $-4.0E-6/\text{yr}$  without operator action. The change in LERF is estimated to be  $-1.4E-7/\text{yr}$  with and  $-2.8E-7/\text{yr}$  without operator action. The operator actions credited in RI-ISI analyses are actions that the operators can take to mitigate the affects of segment ruptures. For example, loss of inventory and diversion of flow can be stopped following a rupture in some segments by closing an isolation valve upstream of the rupture. Because operator actions mitigate the affects of ruptures, the estimated CDFs and LERFs without crediting these actions are greater, and sometimes much greater, than the estimates that credit the action. Consequently, the absolute magnitude of the estimated changes in CDF and LERF due to the implementation of an RI-ISI program may be greater for the without-operator action estimates than the with-operator action estimates.

The licensee did not submit estimates for the other risk change criteria in Section 4.4.2 of WCAP-14572, Revision 1-NP-A. However, TVA stated in Reference 2 that they made all the changes in risk calculations according to the guidance on page 213 of WCAP-14572, Revision 1-NP-A, as applicable, and applied all four criteria for evaluating the results. Fifteen segments and inspection locations were added until all of the four criteria discussed on pages 214 and 215 of the WCAP-14572, Revision 1-NP-A, were satisfied. Based on the use of the approved methodology and on the reported results, the staff finds that any change in risk associated with the implementation of the RI-ISI program is small and consistent with the intent of the Commission's Policy Statement (Ref. 7) and, therefore, is consistent with RG 1.178.

### 3.4 Integrated Decisionmaking

As described in the May 21, 2001, and September 28, 2001, TVA submittals, TVA used an integrated approach in defining the proposed RI-ISI program. TVA considered, in concert, the traditional engineering analysis, risk evaluation, and the implementation and performance monitoring of piping under the program. This complies with the guidelines of RG 1.178.

The selection of pipe segments to be inspected is described in Section 3.8 of Reference 1 using the results of the risk category rankings and other operational considerations. The licensee stated that it used the methodology described in WCAP-14572, Revision 1-NP-A to guide the selection of the number and the location of examination elements within the piping segments.

Revised Table 3.4-1 in Reference 2 gives failure probability estimates for small leaks and disabling leaks corresponding to the dominant potential degradation mechanisms for various

systems in WBN. Table 5-1 of Reference 1 provides a summary table comparing the number of inspections required under the existing ASME, Section XI, ISI program at WBN with the alternative RI-ISI program.

The licensee used the methodology described in WCAP-14572, Revision 1-NP-A, for targeted examination volumes (typically associated with welds) and methods of examination based on the type(s) of degradation expected. The staff has reviewed these guidelines and has determined that, if implemented as described, the RI-ISI examinations should result in improved discovery of service-related discontinuities over that currently provided by the Code.

The objective of ISI required by the Code is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary that may impact plant safety. Therefore, the RI-ISI program must meet this objective to be found acceptable for use. Further, since the risk-informed program is based on inspection for cause, element selection should target specific degradation mechanisms. Section 4 of WCAP-14572, Revision 1-NP-A, provides guidelines for the areas and/or volumes to be inspected as well as the examination method, acceptance standard, and evaluation standard for each degradation mechanism. Based on a review of the cited portion of WCAP-14572, Revision 1-NP-A, the staff concludes that the examination methods are appropriate since they are selected based on specific degradation mechanisms, pipe sizes, and materials of concern.

### 3.5 Implementation and Monitoring

Implementation and performance monitoring strategies require careful consideration by the licensee and are addressed in Element 3 of RG 1.178 and SRP 3.9.8. The objective of Element 3 is to assess performance of the affected piping systems under the proposed RI-ISI program by implementing monitoring strategies that confirm the assumptions and analyses used in the development of the RI-ISI program. To approve an alternative pursuant to 10 CFR 50.55a(a)(3)(i), implementation of the RI-ISI program, including inspection scope, examination methods, and methods of evaluation of examination results, must provide an acceptable level of quality and safety.

The licensee stated in its submittal that TVA will prepare procedures that comply with the WCAP-14572, Revision 1-NP-A guidelines to implement and monitor the RI-ISI program upon approval of the RI-ISI program. The licensee confirmed that it will retain the applicable portions of the Code not affected by the change, such as inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements.

The licensee stated in Section 4 of Reference 1 that the RI-ISI program is a living program and its implementation will require feedback of new relevant information to ensure the appropriate identification of HSS piping locations. Reference 1 also stated that, as a minimum, risk ranking of piping segments will be reviewed and evaluated on an ASME ISI periodic basis and that significant changes may require more frequent adjustments as recommended by an NRC Bulletin, Generic Letter, or by industry and plant-specific feedback.

The proposed periodic reporting requirements meet existing ASME Code requirements and applicable regulations and, therefore, are considered acceptable. The staff finds that the proposed process for RI-ISI program updates meets the guidelines of RG 1.174 that

risk-informed applications should include performance monitoring and feedback provisions; therefore, the process for program updates is acceptable.

#### 4.0 CONCLUSIONS

In accordance with 10 CFR 50.55a(a)(3)(i), proposed alternatives to regulatory requirements may be used when authorized by the NRC when the applicant demonstrates that the alternative provides an acceptable level of quality and safety. In this case, the licensee's proposed alternative is to use the RI-ISI process described in the NRC-approved report WCAP-14572, Revision 1-NP-A. The staff concludes that the licensee's proposed alternative will provide an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)(3)(i) for the proposed alternative to the piping ISI requirements with regard to the number of inspections, locations of inspections, and methods of inspection.

The staff finds that the results of different elements of the engineering analysis are considered in an integrated decision-making process. The impact of the proposed changes in the ISI program is founded on the adequacy of the engineering analysis and acceptable estimation of changes in plant risk in accordance with RG 1.174 and RG 1.178 guidelines.

The WBN methodology also considers implementation and performance monitoring strategies. Inspection strategies ensure that failure mechanisms of concern have been addressed and there is adequate assurance of detecting damage before structural integrity is affected. TVA takes into account the risk significance of piping segments in defining the inspection scope for the RI-ISI program.

The licensee will continue to perform system pressure tests and visual examination of piping structural elements on all ASME Class 1, 2, and 3 systems in accordance with the ASME Code program. The RI-ISI program applies the same performance measurement strategies as existing ASME Code requirements and, in addition, increases the inspection volumes at some weld locations.

The WBN risk-informed methodology provides for conducting an analysis of the proposed changes using a combination of engineering analysis with supporting insights from a PRA. Defense-in-depth and quality are not degraded in that the methodology provides reasonable confidence that any reduction in existing inspections will not lead to degraded piping performance when compared to existing performance levels. Inspections are focused on locations with active degradation mechanisms as well as selected locations that monitor the performance of piping systems.

TVA deviated from the WCAP-14572, Revision 1-NP-A in its submittal regarding taking credit for leak detection in non-RCS piping. The staff has reviewed this deviation as described by the licensee and finds it acceptable in this application.

In addition, the licensee submitted Relief Request 1-RI-ISI-02 for WBN, which requested performing visual VT-2 examinations each refueling outage as an alternative to the volumetric examinations specified in Code Case N-577 and in WCAP-14572, Revision 1-NP-A, for those high safety-significant branch connection welds less than or equal to 2 inches nominal pipe size and socket welds identified in the RI-ISI program. The staff concurs that volumetric examination of these welds is inconclusive and impractical due to the geometric limitations

imposed by branch connection welds less than or equal to 2 inches nominal pipe size and socket welds. The staff also concurs that it is not necessary to perform the Code-required surface examination of these welds in the absence of an environment which would cause outside surface-initiated flaws. Therefore, TVA's proposed alternative examination method is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that performing either the volumetric or the surface examinations of the branch connection welds less than or equal to 2 inches nominal pipe size and socket welds would result in unusual difficulty without a compensating increase in the level of quality and safety.

The staff's review of the licensee's proposed RI-ISI program concludes that the program is an acceptable alternative to the current ISI program, which is based on ASME Code, Section XI, requirements for Code Class 1, Categories B-F and B-J welds and for Code Class 2, Categories C-F-1 and C-F-2 welds.

The licensee's proposed RI-ISI program (Relief Request 1-RI-ISI-01) is authorized for the first 10-year ISI interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that the request provides an acceptable level of quality and safety. In addition, Relief Request 1-RI-ISI-02 is authorized for the first 10-year ISI interval pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that performing volumetric or surface examinations would result in unusual difficulty without a compensating increase in the level of quality and safety.

## 5.0 REFERENCES

1. Letter, dated May 21, 2001, P. Pace (TVA, Manager, Site Licensing and Industry Affairs) to NRC, containing *Watts Bar Nuclear Plant (WBN) Unit 1 - American Society of Mechanical Engineers (ASME) Section XI Alternative Inservice Inspection Program - Risk Informed Inservice Inspection (RI-ISI) Program*.
2. Letter, dated September 28, 2001, P. Pace (TVA, Manager, Site Licensing and Industry Affairs) to NRC, containing *Watts Bar Nuclear Plant (WBN) Unit 1 - Request for Additional Information on the American Society of Mechanical Engineers (ASME) Section XI Alternative Inservice Inspection Program Risk Informed Inservice Inspection (RI-ISI) Program (TAC No. MB2082)*.
3. WCAP-14572, Revision 1-NP-A, *Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report*, February 1999.
4. NRC RG 1.174, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis*, July 1998.
5. NRC RG 1.178, *An Approach for Plant-Specific Risk-Informed Decision Making: Inservice Inspection of Piping*, September 1998.
6. NRC NUREG-0800, Chapter 3.9.8, *Standard Review Plan for Trial Use for the Review of Risk-Informed Inservice Inspection of Piping*, September 1998.
7. NRC, "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities; Final Policy Statement," *Federal Register*, Vol. 60, p. 42622, August 16, 1995.

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