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Technical Evaluation Report on the First 10-Year Interval Inservice Inspection Program Plan: Tennessee Valley Authority, Watts Bar Nuclear Plant, Unit 1 Docket Number 50-390

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Attachment 2

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ABSTRACT

This report presents the results of the evaluation of the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, submitted by letter dated May 9, 1996, including the requests for relief from the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, requirements that the licensee has determined to be impractical. The first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, is evaluated in Section 2 of this report. The inservice inspection (ISI) plan is evaluated for (a) compliance with the appropriate edition/addenda of Section XI, (b) acceptability of examination sample, (c) correctness of the application of system or component examination exclusion criteria, and (d) compliance with ISI-related commitments identified during previous Nuclear Regulatory Commission reviews. The requests for relief are evaluated in Section 3 of this report.

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SUMMARY

The licensee, Tennessee Valley Authority, has prepared the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, to meet the requirements of the 1989 Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI. The first 10-year interval began May 27, 1996, and will end on May 26, 2006.

The information in the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, submitted by letter dated May 9, 1996, was reviewed. Included in the review were the requests for relief from the ASME Code Section XI requirements that the licensee has determined to be impractical. As a result of this review, requests for additional information (RAI) were prepared describing the information and/or clarification required from the licensee in order to complete the review. The licensee provided the requested information in submittals dated November 25, 1996, March 24, 1997, and August 8, 1997.

Based on the review of the Program Plan, the licensee's response to the Nuclear Regulatory Commission's RAIs, and the recommendations for granting relief from the ISI examinations that cannot be performed to the extent required by Section XI of the ASME Code, no deviations from regulatory requirements or commitments were identified in the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, except as noted in the evaluation of Request for Relief 1-ISI-1.

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TECHNICAL EVALUATION REPORT ON THE FIRST 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN: TENNESSEE VALLEY AUTHORITY, WATTS BAR NUCLEAR PLANT, UNIT 1 DOCKET NUMBER 50-390

1. INTRODUCTION

Throughout the service life of a water-cooled nuclear power facility, 10 CFR 50.55a(g)(4) (Reference 1) requires that components (including supports) that are classified as American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Class 1, Class 2, and Class 3 meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, (Reference 2) to the extent practical within the limitations of design, geometry, and materials of construction of the components. This section of the regulations also requires that inservice examinations of components and system pressure tests conducted during successive 120-month inspection intervals comply with the requirements in the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b) on the date 12 months prior to the start of the 120-month inspection interval, subject to the limitations and modifications listed therein. The components (including supports) may meet requirements set forth in subsequent editions and addenda of this Code that are incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein, and subject to Nuclear Regulatory Commission (NRC) approval. The licensee, Tennessee Valley Authority (TVA), has prepared the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, (Reference 3) to meet the requirements of the 1989 Edition of the ASME Code, Section XI. The first 10-year interval began May 27, 1996.

Pursuant to 10 CFR 50.55a(a)(3), proposed alternatives to the Code requirements may be used when authorized by the NRC. The licensee must demonstrate either that the proposed alternatives provide an acceptable level of quality and safety, or that Code compliance would result in hardship or unusual difficulty without a compensating increase in safety. Pursuant to 10 CFR 50.55a(g)(5)(iii), if the licensee determines that conformance with certain Code examination requirements is impractical for its facility, the licensee shall submit information to the NRC to support that determination. Pursuant to 10 CFR 50.55a(g)(6)(i), the NRC will evaluate the licensee's determination that Code requirements are impractical. The NRC may grant relief and may impose alternative requirements that it determines 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 on the facility.

The information in the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, submitted by letter dated May 9, 1996, was reviewed, including the requests for relief from the ASME Code Section XI requirements that the licensee has determined to be impractical. This review was performed using the standard review plans of NUREG-0800, Section 5.2.4, "Reactor Coolant Boundary Inservice Inspections and Testing," and Section 6.6, "Inservice Inspection of Class 2 and 3 Components" (Reference 4).

In letters dated September 25, 1996 (Reference 5), January 21, 1997 (Reference 6), and June 20, 1997 (Reference 7), the NRC requested additional information that was necessary to complete the review of the inservice inspection (ISI) program plan. In responses dated November 25, 1996 (Reference 8), March 24, 1997 (Reference 9), and August 8, 1997 (Reference 10), Tennessee Valley Authority provided the requested information, submitted two new requests for relief, and revised several requests for relief.

The first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, is evaluated in Section 2 of this report. The ISI program plan is evaluated for (a) compliance with the appropriate edition/addenda of Section XI, (b) acceptability of examination sample, (c) correctness of the application of system or component examination exclusion criteria, and (d) compliance with ISI-related commitments identified during the NRC's previous reviews. The requests for relief are evaluated in Section 3 of this report. Unless otherwise stated, references to the Code refer to the ASME Code, Section XI, 1989 Edition. Inservice test programs for pumps and valves and for snubbers are being evaluated in other reports.

2. EVALUATION OF INSERVICE INSPECTION PROGRAM PLAN

This evaluation consists of a review of the applicable program documents to determine whether or not they are in compliance with the Code requirements and any previous license conditions pertinent to ISI activities. This section describes the submittals reviewed and the results of the review.

2.1 Documents Evaluated

Review has been completed on the following information from the licensee:

- The first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, submittal dated May 9, 1996 (Reference 3)

- Licensee's "Response to Request for Additional Information - Inservice Inspection Program", dated November 25, 1996 (Reference 8)

- Licensee's "Response to Request for Additional Information - Inservice Inspection Program", dated March 24, 1997 (Reference 9)

- Licensee's "Response to Request for Additional Information - Inservice Inspection Program", dated August 8, 1997 (Reference 10).

2.2 Compliance with Code Requirements

2.2.1 Compliance with Applicable Code Editions

Inservice inspection program plans are to be based on Section XI of the ASME Code editions defined in 10 CFR 50.55a(g)(4) and 10 CFR 50.55a(b). The first interval at Watts Bar Nuclear Plant, Unit 1, began May 27, 1996; therefore, the Code applicable to the first interval ISI program is the 1989 Edition. As stated in Section 1 of this report, the licensee has prepared the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, to meet the requirements of 1989 Edition of the ASME Code.

In accordance with 10 CFR 50.55a(c)(3), 10 CFR 50.55a(d)(2), and 10 CFR 50.55a(e)(2), ASME Code cases may be used as alternatives to Code requirements. Code cases that the NRC has approved for use are listed in Regulatory Guide 1.147, *Inservice Inspection Code Case Acceptability,* (Reference 11) with any additional conditions the NRC may have imposed. When used, these Code cases must be implemented in their entirety. Published Code cases awaiting approval and subsequent listing in Regulatory Guide 1.147 may be adopted only if the licensee requests, and the NRC authorizes, their use on a case-by-case basis.

The licensee's first 10-year ISI program includes the Code cases listed below. These Code cases either have been approved for use in Regulatory Guide 1.147 or are included as requests for relief, as noted.

Code Case N-307-1	*Revised Ultrasonic Examination Volume for Class 1 Bolting, Table IWB-2500-1, Examination Category B-G-1, When the Examinations Are Conducted From the Center-Drilled Hole*
Code Case N-416-1	*Alternative Pressure Test Requirement for Welded Repairs or Installation of Replacement Items by Welding, Class 1, 2, and 3* (Relief Request PR-01, Approved for use by NRC Safety Evaluation Report dated April 13, 1995)
Code Case N-435-1	*Alternative Examination Requirements for Vessels with Wall Thickness 2 in. or Less*
Code Case N-457	*Qualification Specification Notch Location for Ultrasonic Examination of Bolts and Studs*
Code Case N-460	*Alternative Examination Coverage for Class 1 and 2 Welds*
Code Case N-461	*Alternative Rules for Piping Calibration Block Thickness*
Code Case N-463-1	*Evaluation Procedures and Acceptance Criteria for Flaws in Class 1 Ferritic Piping that Exceed the Acceptance Standards of IWB-3514.2*
Code Case N-481	*Alternative Examination Requirements for Cast Austenitic Pump Casings*
Code Case N-491	*Alternative Rules for the Examination of Class 1, 2, and 3 and MC Components and Supports of Light Water Cooled Power Plants*
Code Case N-494-1	*Pipe Specific Evaluation Procedures and Acceptance Criteria for Flaws in Class 1 Ferritic Piping that Exceed the Acceptance Standards of IWB-3514.2*
Code Case N-498-1	*Alternative Rules for 10-Year Systems Hydrostatic Testing for Class 1, 2, and 3 Systems* (Relief Request PR-03, Approved for use by NRC Safety Evaluation Report dated February 27, 1995).
Code Case N-503	*Limited Certification of Nondestructive Examination Personnel.*

Code Case N-509 — *Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments* (Evaluated in Request for Relief 1-ISI-2).

Code Case N-524 — *Alternative Examination Requirements for Longitudinal Welds in Class 1 and 2 Piping* (Evaluated in Request for Relief 1-ISI-3).

Code Case N-546 — *Alternative Requirements for Qualification of VT-2 Examination Personnel* (Evaluated in Request for Relief 1-ISPT - 07).

2.2.2 Acceptability of the Examination Sample

Inservice volumetric, surface, and visual examinations shall be performed on ASME Code Class 1, 2, and 3 components and their supports using sampling schedules described in Section XI of the ASME Code and 10 CFR 50.55a(b). Sample size and weld selection procedures have been implemented in accordance with the Code and 10 CFR 50.55a(b) and appear to be correct.

2.2.3 Exemption Criteria

The criteria used to exempt components from examination shall be consistent with Paragraphs IWB-1220, IWC-1220, IWC-1230, IWD-1220, and 10 CFR 50.55a(b). The exemption criteria have been applied by the licensee in accordance with the Code, as discussed in the ISI program plan, and appear to be correct.

2.2.4 Augmented Examination Commitments

In addition to the requirements specified in Section XI of the ASME Code, the licensee has committed to perform the following augmented examinations:

* In-place ultrasonic examination of the areas of higher stress concentration at the bore and keyway of the reactor coolant pump flywheel during refueling or maintenance outages (approximately 3-year intervals), and surface examination of all exposed surfaces and complete ultrasonic examination (approximately 10-year intervals) as required by Section XI [Regulatory Guide 1.14 (Reference 12)].

* Ultrasonic testing on the guide tube support pins each outage based on information provided by Westinghouse.

2.3 Conclusion

Based on the review of the documents listed in Section 2.1, no deviations from regulatory requirements or commitments were identified in the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1.

Note that this report does not include a review of the implementation of the augmented examinations, it merely records that the licensee has committed to perform them.

3. EVALUATION OF RELIEF REQUESTS

The requests for relief from the ASME Code requirements that the licensee has determined to be impractical for the first 10-year inspection interval are evaluated in the following sections.

3.1 Class 1 Components

3.1.1 Reactor Pressure Vessel

No relief requests.

3.1.2 Pressurizer

No relief requests.

3.1.3 Heat Exchangers and Steam Generators

No relief requests.

3.1.4 Piping Pressure Boundary

No relief requests.

3.1.5 Pump Pressure Boundary

No relief requests.

3.1.6 Valve Pressure Boundary

No relief requests.

3.1.7 General

No relief requests.

3.2 Class 2 Components

3.2.1 Pressure Vessels

No relief requests.

3.2.2 Piping

No relief requests.

3.2.3 Pumps

No relief requests.

3.2.4 Valves

No relief requests.

3.2.5 General

No relief requests.

3.3 Class 3 Components

3.3.1 Piping

3.3.1.1 Request for Relief 1-ISI-1 (Revised per letter dated 11/25/96), ASME Code Class 3 Integrally Welded Attachments

Code Requirement—ASME Section XI, Examination Categories D-A, D-B, and D-C, Items D1.20 through D1.60, D2.20 through D2.60, and D3.20 through D3.60 require VT-3 visual examination of Class 3 systems as defined by Figure IWD-2500-1.

Licensee's Proposed Alternative— Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the requirements of the Code. Specifically, the licensee proposes to use the requirements of the 1991 Addenda for VT-3 visual examination of integral attachments in Auxiliary Feedwater System Piping; this Addenda exempts NPS 1 and smaller.

Licensee's Basis for the Proposed Alternative—

"The majority of NPS 1 and smaller auxiliary feedwater piping is field routed. Identification of supports and integrally welded attachments on this piping would be labor intensive. The identification process would require walkdowns of vent lines, drain lines, instrumentation lines and sampling lines. Subsequent to the walkdowns, substantial resources will be required to sketch the applicable lines and check, verify and maintain the resulting sketches.

"Code Class 3 NPS 1 and smaller piping is not analyzed for pipe rupture, due to the low safety significance associated with rupture of these lines.

"ASME Section XI 1991 Addenda and later incorporated the NPS 1 and smaller exemption requirements for the Auxiliary Feedwater System. The exemption includes piping NPS 1 and smaller and exemptions for vessels, pumps, and valves and their connections in piping NPS 1 and smaller.

"Watts Bar believes that it is an unnecessary burden to inspect supports and integrally welded attachments on NPS 1 and smaller piping in the Class 3 Auxiliary Feedwater System. The inspection of these items will impose costs without an increase in the safety or quality of the unit.

"This request is to use the NPS 1 and smaller exemption on Auxiliary Feedwater System piping. Watts Bar believes it is an unnecessary burden to examine supports and integrally welded attachments on NPS 1 and smaller piping in the Code Class 3 Auxiliary Feedwater System. Utilization of the NPS 1 and smaller exemption criteria is more stringent than the exemption criteria utilized for Class 2 components and is similar to the NPS 1 and smaller exemption utilized for Class 1 components. Prior to the Winter 1980 Addenda, Section XI did not have a requirement to examine Class 3 NPS 1 and smaller Auxiliary Feedwater System piping supports and integrally welded attachments. The later 1991 Addenda IWD-1220 of Section XI incorporated the NPS 1 and smaller exemption to provide clarification on the exemptions.

"Utilizing the NPS 1 and smaller exemption criteria for the Auxiliary Feedwater System, an acceptable level of quality and safety will be achieved. Pursuant to 10 CFR 50.55a (a)(3)(ii), it is recommended that relief be granted."

Evaluation—In lieu of the Code-required VT-3 visual examinations of integral attachment welds in piping NPS 1 and smaller in the PWR Auxiliary Feedwater System, the licensee proposes to use the requirements of the 1991 Addenda, which exempts NPS 1 and smaller. Based on the licensee's proposed use of Code Case N-509, the INEEL believes no significant burden exists. Code Case N-509 requires the licensee to inspect a minimum of 10 percent of <u>all</u> Class 1, Class 2, and Class 3 integrally welded attachments to piping, pumps, and valves. Use of this Code Case constitutes a significant reduction in the total number of components requiring examination.

Conclusion—Based on the licensee's proposed use of Code Case N-509 (see Request for Relief 1-ISI-2), the INEEL staff believes that it has not been demonstrated that a significant burden exists. Therefore it is recommended that this request for relief be denied.

3.3.2 Pumps

No relief requests.

3.3.3 Valves

No relief requests.

3.3.4 General

No relief requests.

3.4 Pressure Tests

3.4.1 Class 1 System Pressure Tests

3.4.1.1 Request for Relief ISPT - 05 (Revised per letter dated 3/24/97), 10-Year Hydrostatic Test Requirements for Code Class 1 Components

Code Requirement—The requirements for system hydrostatic testing are contained in Table IWB-2500-1, Category B-P, Items B15.11, B15.51, B15.61, and B15.71 (for Class 1 systems). The Code requires system hydrostatic testing once per 10-year interval, at or near the end of the interval.

Licensee's Proposed Alternative— Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to ASME Section XI hydrostatic test requirements for Code Class 1 vents, drains, test and fill piping which range in diameter from 3/4 to 2 inches. The licensee stated:

"These piping segments will continue to be visually inspected following each refueling outage for leakage and evidence of past leakage during the RCS leakage test. This test is conducted with the RCS at full operating temperature and pressure."

Licensee's Basis for the Proposed Alternative—

"Various piping segments are located in open-end tailpipes that serve as vent , drain, test, or fill lines. Manual valves and flanges bound these piping segments to provide the design-required double isolation at the reactor coolant pressure boundary. These piping segments are not normally pressurized. Pressure testing of these piping segments at nominal operating pressure in Mode 3 would require that the inboard isolation valve be opened when the reactor coolant system (RCS) is at full temperature and pressure. The action would violate the design requirement for double isolation valve protection. The potential for spills when opening the system presents a significant risk of personnel contamination. Pressure testing in Mode 6 would require that a hydrostatic pump be connected at each segment location. However, for some segments there is no connection available and would require a modification for installation of a pump connection. These piping segments are located in high-radiation areas and testing would result in high personnel radiation exposure. A breakdown of the dose estimates for each radiation area in the plant is provided below:

"A. RCS Lop Drains
6 items at 10 person-hours per item at 300 mR/hour

"B. Reactor Vessel Head Vents
2 items at 10 person-hours per item at 150 mR/hour and
2 items at 8 person-hours per item at 20 mR/hour.

"C. Pressurizer Spray Vents
2 items at 10 person-hours per item at 200 mR/hour.

"D. Excess Letdown Drain
1 item at 8 person-hours per item at 50 mR/hour.

"E. RCS Seal Drains and Vents
4 items at 8 person-hours per item at 20 mR/hour and
4 items at 8 person-hour per item at 50 mR/hour

"This results in a total of approximately 28 Rem of dose accumulated in performing these tests. This data is based on estimated durations and actual survey data from refueling outage 5 for Units 1 and 2 at TVA's Sequoyah Nuclear Plant which is very similar in design to WBN. These radiation exposure estimates are based on the removal of blind flanges, the installation of test flanges and the connection of hydrostatic pump. Personnel would remain in the area to perform the test, disconnect the test equipment, and reinstall the blind flange.

"These piping segments are visually inspected each refueling outage as the unit returns to operation. These segments are not specifically pressurized past the first isolation valve for this inspection. It is possible that the piping is pressurized because of leakage at the first isolation valve. With these inspections being performed approximately six times in each inspection interval, the increase in safety achieved from the required nominal operating pressure test is not commensurate with the hardship of performing such testing. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that relief be granted."

Evaluation—The Code requires a system hydrostatic test to be performed once per interval in accordance with IWA-5000 for Class 1 components. The pressure test is to be applied to the components within the Class boundary. Vents and drains are typically designed with redundant isolation valves. The first off valve is the primary isolation while the second off provides redundant isolation. These valves are only opened and closed for system draining and venting. Under normal operating conditions, these valves would normally be closed. Requiring the licensee to open the primary valve for the purpose of pressurizing the second valve results in unnecessary radiation exposure and additional radioactive waste (the contaminated water that will be introduced between the isolation valves). Performing a visual examination on the outermost isolation valve of the subject lines for evidence of leakage will provide reasonable assurance of operational readiness. Therefore, the INEEL staff believes that requiring the licensee to open the primary isolation valve for the sole purpose of pressurizing the secondary isolation valve serves no practical purpose and results in a burden with no compensating increase in quality and safety.

Conclusion— Compliance with the Code's hydrostatic testing requirements for the subject piping segments results in hardship and/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 for Watts Bar Nuclear Plant, pursuant to 10 CFR 50.55a(a)(3)(ii).

3.4.2 Class 2 System Pressure Tests

No relief requests.

3.4.3 Class 3 System Pressure Tests

No relief requests.

3.4.4 General

3.4.4.1 Request for Relief ISPT - 01 (Revised per letter dated 3/24/97), 10-Year Hydrostatic Test Requirements for Code Class 1, 2, and 3 Systems

Code Requirement—The requirements for system hydrostatic testing are contained in Table IWB-2500-1, Category B-E, Items B4.11, B4.12, and B4.13, and Category B-P, Items B15.11, B15.51, B15.61, and B15.71 (for Class 1 systems); Table IWC-2500-1, Category C-H, Items C7.20, C7.40, C7.60, and C7.80 (for Class 2); and Table IWD-2500-1, Categories D-A, D-B, and D-C, Items D1.10, D2.10, and D3.10 (for Class 3). The Code requires system hydrostatic testing once per 10-year interval at or near the end of the interval.

Licensee's Proposed Alternative—Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee proposed an alternative to the periodic system hydrostatic pressure tests on Code Class 1, 2, and 3 systems. The licensee stated:

"The requirements of ASME Code ASME Code Case N-498-1 will be followed in lieu of the requirement to perform periodic system hydrostatic pressure tests on Code Class 3 systems."

Licensee's Basis for the Proposed Alternative—

"The performance of a hydrostatic pressure test requires the removal of large portions of the system from service, the over-torquing or blocking of boundary valves, the removal, or gagging, of system relief valves, the installation of test pressure relief valves, and the purchase of special hydrostatic pressure pumps and test gauges. Most code class 3 systems have system design temperatures less than 200°F and, therefore, a hydrostatic test pressure of 110 percent of design pressure. This test pressure is only 25 to 40% above normal operating pressure for most code class 3 systems. Past experience in code class 3 system pressure tests at TVA's other two nuclear plants (Browns Ferry units 1, 2, and 3 and Sequoyah units 1 and 2) has shown that this small increase in pressure has not enabled the detection of system leakage that would not have been detected during a system inservice or functional test.

"Significant effort and expense are incurred in the performance of Code Class 3 hydrostatic pressure tests in comparison to the information obtained during the test. The increase in the level of quality and safety achieved in the performance of these tests is not commensurate with the hardship to the plant. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that relief be granted."

Evaluation—The Code requires a system hydrostatic test to be performed once per interval in accordance with IWA-5000 for Class 1, 2, and 3 pressure-retaining systems. In lieu of the Code requirement, the licensee proposes to implement the alternatives to Code requirements contained in Code Case N-498-1, *Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems*, dated May 11, 1994.

The system hydrostatic test stipulated in Section XI is not a test of the structural integrity of the system but rather an enhanced leakage test (Reference 13). Hydrostatic testing only subjects the piping components to a small increase in pressure over the design pressure; therefore, piping dead weight, thermal expansion, and seismic loads present far greater challenges to the structural integrity of the system. Consequently, the Section XI hydrostatic pressure test is regarded primarily as a means to enhance leak detection rather than as a method to determine structural integrity. In addition, industry experience indicates that leaks are not being discovered as a result of hydrostatic test pressures causing a preexisting flaw to propagate through the wall—in most cases leaks are being found when the system is at normal operating pressure.

In lieu of 10-year hydrostatic pressure testing at or near the end of the 10-year interval, Code Case N-498-1 requires a VT-2 visual examination at nominal operating pressure and temperature in conjunction with a system leakage test performed in accordance with paragraph IWA-5000 of the 1992 Edition of Section XI. The requirements of Code Case N-498-1 for Class 1 and 2 systems are the same as those of Code Case N-498, *Alternative Rules for 10-Year System Hydrostatic Testing for Class 1 and 2 Systems*, which was previously approved for general use on Class 1 and 2 systems in Regulatory Guide 1.147, Rev. 9. For Class 3 systems, N-498-1 requirements are identical to those for Class 2 components.

Class 3 systems do not normally receive the amount and/or type of nondestructive examinations that Class 1 and 2 systems receive. While Class 1 and 2 system failures are relatively uncommon, Class 3 leaks occur more frequently and are caused by different failure mechanisms. Based on a review of Class 3 system failures requiring repair during the last 5 years[a], the most common causes of failures are erosion-corrosion (EC), microbiologically-induced corrosion (MIC), and general corrosion. In general, licensees have implemented programs for the prevention, detection, and evaluation of EC and MIC; therefore, Class 3 systems receive inspections commensurate with their functions and expected failure mechanisms.

System hydrostatic testing entails considerable time, radiation dose, and economic resources. The safety assurance provided by the enhanced leakage detection gained from a slight increase in system pressure during a hydrostatic test may be offset or negated by the necessity to gag or remove Code safety and/or relief valves (placing the system, and thus the plant, in an off-normal state), erect temporary supports in steam lines, and expend

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a. Documented in Licensee Event Reports and the Nuclear Plant Reliability Data System databases.

resources to set up testing with special equipment and gages. Therefore, performance of system hydrostatic testing represents a considerable burden. Giving consideration to the minimal amount of increased assurance provided by the increased pressure associated with a hydrostatic test versus the pressure for the system leakage test, and the hardship associated with performing the hydrostatic test, the INEEL staff finds that compliance with the Section XI hydrostatic testing requirements results in hardship and/or unusual difficulty without a compensating increase in the level of quality and safety.

Conclusion— Compliance with the Code's hydrostatic testing requirements results in hardship and/or unusual difficulty without a compensating increase in the level of quality and safety. Performing the hydrostatic pressure test in accordance with Code Case N-498-1 will provide reasonable assurance of operational readiness. Therefore, it is recommended that the licensee's proposed alternative, to implement the pressure test rules of Code Case N-498-1 for Code Class 1, 2, and 3, be authorized for WBN, pursuant to 10 CFR 50.55a(a)(3)(ii). This alternative 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 is to follow all provisions in Code Case N-498-1, with limitations issued in Regulatory Guide 1.147, if any.

3.4.4.2 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

This request for relief was previously evaluated and the licensee's proposed alternative was authorized in a Safety Evaluation Report (SER) dated September 23, 1997.

3.5 General

3.5.1 Ultrasonic Examination Techniques

No relief requests.

3.5.2 Exempted Components

No relief requests.

3.5.3 Other

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

This request for relief was previously evaluated and the licensee's proposed alternative was authorized in a Safety Evaluation Report (SER) dated September 23, 1997.

3.5.3.2 Request for Relief ISPT - 04 (Revised per letter dated 3/24/97), Table IWC-2500-1, Examination Category C-H, Items C7.10, C7.30, C7.50, and C7.70, Pressure-Retaining Components

Code Requirement— Section XI, Table IWC-2500-1, Examination Category C-H, Items C7.10, C7.30, C7.50, and C7.70 require a VT-2 visual examination during System Functional and System Inservice Pressure Tests.

Licensee's Proposed Alternative— Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed an alternative to performing the Code-required VT-2 visual examination during System Functional and System Inservice Pressure Tests for the portions of the containment penetration pipe classified as Code Class 2. The attaching segments of lines, inside and outside of containment, are nonclass. The licensee stated:

> "The alternative test requirements of ASME Code Case N-522 shall be used. In addition, when Code Case N-522 is applied, a procedure for the detection and location of through-wall flaws will be implemented."

Licensee's Basis for the Proposed Alternative—

"The portion of piping that penetrates containment and the associated inboard and outboard containment isolation valves are required to be constructed in accordance with Class 1 or 2 design requirements. For non-safety systems the sole function of the penetration and the associated isolation valves are to provide containment isolation capability for the protection of containment integrity during the event of a loss of the attached non-safety piping. In all cases the isolation valves associated with these penetrations are maintained during normal operation in the locked closed position, or close upon receipt of a containment isolation signal. The safety function of these penetrations is verified by 10 CFR 50 Appendix J leak rate testing performed on all containment isolation valves and penetrations.

"The performance of pressure testing, as required by Table IWC-2500-1, Category C-H, is considered unnecessary in the sense that there is minimal enhancement to quality or safety resulting from the additional testing, and results in additional personnel radiation exposure and outage costs. It is the position of WBN that pressure testing of these containment penetrations presents a hardship to the plant without providing a commensurate increase in the level of safety of quality. The testing pursuant to 10CFR50 Appendix J requirements provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), it is recommended that relief be granted."

Evaluation—The licensee proposed to implement the alternatives contained in Code Case N-522, *Pressure Testing of Containment Penetration Piping*, for portions of the lines that are Class 2 at the containment penetration. These segments of lines are safety-related only because they function as part of the containment pressure boundary and are relied on for containment integrity. Therefore, it is logical to test the penetration piping portion of the associated systems to the containment test criteria found in 10 CFR 50.55a, Appendix J.

Appendix J pressure tests are local leak rate and integrated leak rate tests that verify the leak-tight integrity of the primary reactor containment and of systems and components that penetrate containment. In addition, Appendix J test frequencies provide assurance that the containment pressure boundary is being maintained at an acceptable level while monitoring for deterioration of seals, valves, and piping. Use of Appendix J, Option B results in tests being performed at intervals not exceeding 60 months versus 40 months as required by the Code. The staff has determined that these containment testing frequencies are acceptable, therefore they should also be considered acceptable for the subject piping.

The Class 2 containment isolation valves (CIVs) and connecting pipe segments must withstand the peak calculated containment internal pressure related to the maximum design containment pressure. The INEEL finds that the pressure-retaining integrity of the CIVs and connecting piping and their associated safety functions may be verified with an Appendix J, Type C test if it is conducted at the peak calculated containment pressure. The seal between the connecting pipe segment and containment may be verified using an Appendix J, Type B test. Therefore, when the connecting pipe segment is subjected to either a Type B or C test, its safety function is verified by the Appendix J test.

Section XI, IWC-5210(b) requires that, where air or gas is used as a testing medium, the test procedure include methods for detection and location of through-wall leakage. If the licensee's test procedure uses air as a testing medium, the procedure should meet the above requirement for the CIVs and pipe segments between the CIVs.

The INEEL staff believes that an acceptable level of quality and safety will be provided by Appendix J tests, when the leak test is performed at the peak calculated containment design pressure and the test procedure provides for detection and location of through-wall leaks.

Conclusion— It is recommended that the licensee's proposed alternative to the Code-required pressure tests, the use of Code Case N-522 with the stipulations that the leak test will be performed at the peak calculated containment pressure and that the test procedure will provide for detection and location of through-wall leaks, be authorized pursuant to 10 CFR 50.55a(a)(3)(i). The use of alternatives contained in Code Case N-522 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 is to follow all the provisions in Code Case N-522 with limitations issued in Regulatory Guide 1.147, if any.

3.5.3.4 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

This request for relief was previously evaluated and the licensee's proposed alternative was authorized in a Safety Evaluation Report (SER) dated September 23, 1997.

3.5.3.5 Request for Relief ISPT - 07 (Revised per letter dated 3/24/97), Use of Code Case N-546, *Alternative Requirements for* Qualification *of VT-2 Visual Examination Personnel*

This request for relief was previously evaluated and licensee's proposal to use Code Case N-546 was authorized in a Safety Evaluation Report (SER) dated August 11, 1997.

3.5.3.6 Request for Relief 1-ISI-2 (Revised per letter dated 3/24/97), Use of Code Case N-509, *Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments*

Code Requirement— ASME Section XI, Examination Category B-K-1, Items B10.10 and B10.20 require a volumetric or surface examination of integrally-welded attachments as defined by Figures IWB-2500-13, -14, or -15, as applicable. Examination Category C-C, Items C3.10, and C3.20 require surface examination as defined by Figure IWC-2500-5. Examination Categories D-A, D-B, and D-C, Items D1.20 through D1.60, D2.20 through D2.60, and D3.20 through D3.60 require VT-3 visual examination as defined by Figure IWD-2500-1.

Licensee's Proposed Alternative— Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed an alternative to the Code selection requirements for integral attachments. The licensee stated:

> "The requirements of Code Case N-509 will be used for selection and examination of integrally welded attachments as an alternative to the requirements of the 1989 Edition of ASME Section XI. A minimum of 10% of the total number of nonexempt Code Class 1, 2, and 3 integral attachments on piping, pumps and valves shall be examined. In the case of multiple vessels of similar design, function, and service, only one integral attachment of only one of the multiple vessels shall be examined. Examination is required whenever component support member deformation (e.g. broken, bent, or pulled out parts) is identified during operation, refueling, maintenance, examination, inservice inspection, or testing.

Licensee's Basis for the Proposed Alternative—

> "In many cases, performing a surface examination on Class 1 and Class 2 integrally welded attachments requires that removal of pipe clamps. Pipe clamp removal is labor intensive and often destroys bolting in the process. Pipe clamp removal on larger components such as those found on the Main Steam and Feedwater Systems are particularly difficult.
>
> "The costs for preparing and examining integrally welded attachments are significant, as is the attendant additional radiation exposure. Code Case N-509, "Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments, Section XI, Division 1," provides an overall cost savings and exposure reduction without compromising safety or quality.

"By utilizing Code Case N-509, the number of Class 1, Class 2 and Class 3 integrally welded attachments requiring examination is reduced as compared to the number requiring examination from the above code requirements. However, Code Case N-509 increases the Class 1 and 2 integrally welded attachment population subject to examination due to elimination of the base material design to thickness exemption. For Class 3 integrally welded attachments, Code Case N-509 requires a more stringent visual examination method (VT-1 in lieu of a VT-3).

"The costs for preparing and examining integrally welded attachments are significant, as is the attendant additional radiation exposure reduction for selection and examination of integrally welded attachments without compromising safety or quality. Code Case N-509 was accepted by the ASME Section XI Code Committee as an alternative to the provisions in ASME Section XI. The alternative examinations specified in the code case maintain an acceptable level of quality and safety and are sufficient to assure structural integrity for the integrally welded attachments. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), it is recommended that relief be granted."

Evaluation—In lieu of Code requirements for selection and examination of integral attachment welds, the licensee proposes to apply Code Case N-509, *Alternative Rules for the Selection and Examination of Class 1, 2, and 3 Integrally Welded Attachments*, which allows a significant reduction in the total number of examinations performed. The licensee stated that a minimum 10% sample of all nonexempt integral attachment welds on Class 1, 2, and 3 piping, pumps, and valves will be examined.

Many of the Code examination requirements are based on sampling to assure that service-related degradation is not occurring, and it is logical to extend the sampling process to welded integral attachments. Based on the licensee's proposal to sample a minimum of 10% of all integral attachment welds, uniformly distributed among all Code Class 1, 2, and 3 systems, the INEEL staff believes that degradation, if occurring, will be detected. Therefore, the use of the alternatives contained in Code Case N-509, with a minimum 10% selection of all integrally-welded attachments in each Code Class, will provide an acceptable level of quality and safety.

Conclusion—The licensee has proposed to examine integral attachments in accordance with Code Case N-509, with a minimum 10% selection of all nonexempt Code Class 1, 2, and 3 integrally-welded attachments uniformly distributed among all systems. The INEEL staff believes that the licensee's proposed alternative will provide an acceptable 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)(i). Use of alternatives contained in Code Case N-509, with the selection provision noted above, 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-509, with limitations issued in Regulatory Guide 1.147, if any.

3.5.3.7 Request for Relief 1-ISI-3, Use of Code Case N-524, *Alternative Examination Requirements for Longitudinal Welds in Class 1 and 2 Piping, Section XI, Division 1*

Code Requirement— Section XI, Table IWB-2500-1, Examination Category B-J, Item B9.12 requires surface and volumetric examinations of longitudinal piping welds in Class 1 piping 4-inch nominal pipe size and larger to be performed in conjunction with the circumferential welds selected for examination, as defined in Figure IWB-2500-8. The length of longitudinal weld required to be examined is at least one pipe diameter, but not more than 12 inches, from the circumferential weld intersection point.

Examination Categories C-F-1 and C-F-2, Items C5.12, C5.22, C5.52, and C5.62 require volumetric and surface examinations of longitudinal piping welds in Class 2 piping to be performed in conjunction with circumferential welds selected for examination, as defined in Figure IWC-2500-7. At least 2.5t of longitudinal weld is required to be examined. For Items C5.42 and C5.82, a surface examination is required for longitudinal piping welds intersecting circumferential welds selected for examination, as defined in Figure IWC-2500-7. At least 2.5t of longitudinal weld is required to be examined.

Licensee's Proposed Alternative— In accordance with 10 CFR 50.55a(a)(3)(i), the licensee proposed to use the alternatives contained in Code Case N-524 in lieu of the volumetric and/or surface examination of the length of longitudinal piping welds required to be examined in accordance with Tables IWB-2500 and IWC-2500. The licensee stated:

"The requirements of Code Case N-524 will be used for the examination of Class 1 and 2 longitudinal piping welds as an alternative to the examination requirements of the 1989 Edition of ASME Section XI."

Licensee's Basis for the Proposed Alternative—

"The alternative examination requirements of Code Case N-524, "Alternative Examination Requirements for Longitudinal Welds in Class 1 and 2 Piping, Section XI, Division 1," include examination of the subject longitudinal piping welds at intersecting circumferential welds within the examination boundary of the circumferential weld. The following items support the basis for the revised longitudinal piping weld examination boundary:

- Longitudinal Piping welds are fabricated during the manufacturing process under controlled conditions, which produce higher quality welds and more uniform residual stress patterns.
- Longitudinal piping welds undergo heat treatment during the manufacturing process which enhances the material properties of the weld and reduces the residual stress created by welding.
- Throughout the Industry, results of previous weld inspections indicate that longitudinal welds have not been a safety concern, and there has been no evidence of longitudinal weld defects compromising safety at nuclear power plants.

"- The areas of longitudinal piping welds can require acid etching, eddy current examination, or a combination of NDE methods for location. This increases radiological methods for location. This increases radiological exposure, radwaste generation, and overall costs for performance of ASME Section XI examinations.

"The only area a longitudinal weld which may be considered suspect are the ends of the weld where it is adjacent to a field fabricated circumferential weld. This area falls within the examination boundaries for the adjacent circumferential weld when examined in accordance with Code Case N-524.

"Based on the above basis for relief, there is little if any technical benefit to performing inservice examinations on longitudinal piping welds beyond that of Code Case N-524. Code Case N-524 was accepted by the ASME Code Committee as an alternative to the provisions in ASME Section XI for the examination of longitudinal piping welds. The alternative examination specified in the code case maintain an acceptable level of quality and safety and are sufficient to assure structural integrity of longitudinal piping welds. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), it is recommended that relief be granted."

Evaluation—The licensee proposed to implement Code Case N-524 for examination of Class 1 and 2 longitudinal piping welds. The licensee proposed to examine the potentially critical portions of the longitudinal welds (the portion that intersects the circumferential weld) in conjunction with examination of the circumferential welds.

There are distinct differences between the processes used in the manufacturing of longitudinal and circumferential welds which enhance the integrity of longitudinal welds. Longitudinal welds are typically manufactured under controlled shop conditions whereas circumferential welds are usually produced in the field under less than ideal conditions. Longitudinal welds also undergo heat treatment in the shop which improves their material properties and relieves the residual stresses created by welding. In addition, shop manufacturing inspections can be performed under more favorable conditions which further increase the confidence level of the longitudinal weld quality.

When implementing the alternatives contained in Code Case N-524, longitudinal welds need not be examined beyond the examination zone of the associated circumferential weld. When the longitudinal weld can be identified, only that portion of the longitudinal weld intersecting the circumferential weld is required to be examined for flaws parallel and transverse to the weld. Where the longitudinal weld cannot be identified, 100% of the circumferential weld shall be examined for flaws parallel and transverse to the weld to ensure that the longitudinal/circumferential weld intersection is examined. Code Case N-524, when implemented in its entirety, leads to examination of the most critical area (the intersection with the circumferential weld) of the longitudinal weld, and thus provides an acceptable level of quality and safety.

Conclusion—The licensee's proposed alternative, the use of Code Case N-524 for examination of Class 1 and 2 piping longitudinal welds provides an acceptable level of quality and safety. Therefore, it is recommended that the use of Code Case N-524 be approved pursuant to 10 CFR 50.55a(a)(3)(i). Use of Code Case N-524 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 is to follow all provisions in Code Case N-524 with limitations issued in Regulatory Guide 1.147, if any.

4. CONCLUSION

For Request for Relief 1-ISI-1, based on the licensee's planned implementation of Code Case N-509, the INEEL staff believes that it has not been demonstrated that a significant burden exists. Therefore, it is recommended that Request for Relief 1-ISI-1 be denied.

Pursuant to 10 CFR 50.55a(a)(3)(i), it is concluded that for Relief Requests 1-ISI-2, 1-ISI-3, and ISPT-04, the licensee's proposed alternatives will provide an acceptable level of quality and safety in lieu of the Code-required examinations. Therefore, it is recommended that the licensee's proposed alternatives be authorized.

Pursuant to 10 CFR 50.55a(a)(3)(ii), it is concluded that for Relief Requests ISPT-01, and ISPT-05, the licensee has demonstrated that specific Section XI requirements would result in hardship or unusual difficulty without a compensating increase in safety. In these cases, it is also recommended that the proposed alternatives be authorized.

Requests for Relief ISPT-02, ISPT-03, and ISPT-06 were previously evaluated and the licensee's proposed alternatives were authorized in a Safety Evaluation Report dated September 23, 1997.

Request for Relief ISPT-07 was previously evaluated and the licensee's proposed alternative was authorized in a Safety Evaluation Report dated August 11, 1997.

The licensee should continue to monitor the development of new or improved examination techniques. As improvements are achieved, the licensee should incorporate these techniques in the ISI program plan examination requirements.

Based on the review of the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, the licensee's response to the NRC's request for additional information, and the recommendations for granting alternatives for selected ISI examinations required by Section XI of the ASME Code, no deviations from regulatory requirements or commitments were identified, except as noted in the evaluation of Request for Relief 1-ISI-1.

5. REFERENCES

1. Code of Federal Regulations, Title 10, Part 50.

2. American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Division 1,1989 Edition.

3. First 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, submitted May 9, 1996.

4. NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,* Section 5.2.4, "Reactor Coolant Boundary Inservice Inspection and Testing," and Section 6.6, "Inservice Inspection of Class 2 and 3 Components," July 1981.

5. Letter dated September 25, 1996, R. Martin (NRC) to J. A. Scalice (Tennessee Valley Authority) containing request for additional information.

6. Letter dated January 21, 1997, R. Martin (NRC) to J. A. Scalice (Tennessee Valley Authority) containing request for additional information.

7. Letter dated June 20, 1997, R. Martin (NRC) to J. A. Scalice (Tennessee Valley Authority Containing request for additional information.

8. Letter dated November 25, 1996, J. A. Scalice (Tennessee Valley Authority) to Document Control Desk (NRC), containing response to the NRC RAI dated September 25 1996.

9. Letter dated March 24, 1997, J. A. Scalice (Tennessee Valley Authority) to Document Control Desk (NRC), containing response to the NRC RAI dated January 21, 1997.

10. Letter dated August 8, 1997, J. A. Scalice (Tennessee Valley Authority) to Document Control Desk (NRC), containing response to the NRC RAI dated June 20, 1997.

11. NRC Regulatory Guide 1.147, *Inservice Inspection Code Case Acceptability,* Revision 11, October 1994.

12. NRC Regulatory Guide 1.14, *Reactor Coolant Pump Flywheel Integrity,* Revision 1, August 1975.

13. S. H. Bush and R. R. Maccary, *Development of In-Service Inspection Safety Philosophy for U.S.A. Nuclear Power Plants,* ASME, 1971.

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11. ABSTRACT (200 Words or less)

This report presents the results of the evaluation of the first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, submitted by letter dated May 9, 1996, including the requests for relief from the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, requirements that the licensee has determined to be impractical. The first 10-year inspection interval *ASME Section XI ISI/NDE Program,* Revision 0, for Watts Bar Nuclear Plant, Unit 1, is evaluated in Section 2 of this report. The inservice inspection (ISI) plan is evaluated for (a) compliance with the appropriate edition/addenda of Section XI, (b) acceptability of examination sample, (c) correctness of the application of system or component examination exclusion criteria, and (d) compliance with ISI-related commitments identified during previous Nuclear Regulatory Commission reviews. The requests for relief are evaluated in Section 3 of this report.

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