



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
OF THE FIRST TEN YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN  
REQUESTS FOR RELIEF FOR  
TENNESSEE VALLEY AUTHORITY  
SEQUOYAH NUCLEAR POWER PLANT, UNITS 1 AND 2  
DOCKET NUMBERS: 50-327 AND 50-328

1.0 INTRODUCTION

The Technical Specifications for Sequoyah Nuclear Power Plant, Units 1 and 2, state that the inservice inspection of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first ten-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for the Sequoyah Units 1 and 2, first 10-year inservice inspection (ISI) interval is the 1977 Edition with the Summer 1978 Addenda.

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

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

In a letter dated May 26, 1995, Tennessee Valley Authority (TVA) submitted to the NRC its First Ten-Year Interval Inservice Inspection Program Plan requests for relief for the Sequoyah Units 1 and 2. Additional clarification for requests for relief 1-ISI-25 and 2-ISI-30 was provided in a letter dated October 26, 1995 and for request for relief 1-ISI-22 and 2-ISI-22 in a letter dated December 12, 1995.

## 2.0 EVALUATION AND CONCLUSIONS

The staff, with technical assistance from its contractor, the Idaho National Engineering Laboratory (INEL), has evaluated the information provided by the licensee in support of its First Ten-Year Interval Inservice Inspection Program requests for relief for Sequoyah 1 and 2. Based on the information submitted, the staff adopts the contractor's conclusions and recommendations presented in the Technical Evaluation Report attached.

Relief is granted pursuant to 10 CFR 50.55a(g)(6)(i) for requests for relief 1-ISI-19, 1-ISI-20, 1-ISI-21, 1-ISI-22, 1-ISI-23, 1-ISI-24, 1-ISI-26, 1-ISI-27, 2-ISI-20, 2-ISI-21, 2-ISI-22, 2-ISI-23, 2-ISI-24, 2-ISI-25, 2-ISI-26, 2-ISI-27, 2-ISI-28, 2-ISI-29, 2-ISI-31, and 2-ISI-32. For those reliefs the licensee has demonstrated that the required Code examination is impractical. In granting the relief, the staff has considered the burden on the licensee that could result if the Code requirements were imposed.

For relief requests 1-ISI-25 and 2-ISI-30 the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) because compliance with the Code requirements would result in unusual difficulty without a compensating increase in the level of quality and safety.

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IDAHO NATIONAL ENGINEERING LABORATORY  
TECHNICAL LETTER REPORT  
FIRST TEN-YEAR INTERVAL ISI RELIEF REQUESTS  
TENNESSEE VALLEY AUTHORITY,  
SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2  
DOCKET NUMBERS 50-327 AND 50-328

1.0 INTRODUCTION

In a letter dated May 26, 1995, the licensee, Tennessee Valley Authority, submitted Relief Requests 1-ISI-19 through 1-ISI-27 for Unit 1 and Relief Requests 2-ISI-20 through 2-ISI-32 for Unit 2. These requests are for the first ten-year inservice inspection (ISI) intervals at the Sequoyah Nuclear Plant, Units 1 and 2. Clarification for Relief Requests 1-ISI-25 and 2-ISI-30 was provided in a letter dated October 26, 1995, and for Relief Requests 1-ISI-22 and 2-ISI-22 in a letter dated December 12, 1995. The Idaho National Engineering Laboratory (INEL) staff has evaluated the subject relief requests in the following section.

2.0 EVALUATION

The Code of record for the Sequoyah Nuclear Plant, Units 1 and 2, first ten-year ISI intervals is the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, 1977 Edition with the Summer 1978 Addenda. The information provided by the licensee in support of the relief requests has been evaluated and the bases for disposition are documented below.

A. Requests for Relief 1-ISI-19 and 2-ISI-25, Examination Category B-J, Item B9.11, Circumferential Piping Welds

Code Requirement: Table IWB-2500-1, Examination Category B-J, Item B9.11, requires 100% volumetric and surface examinations of circumferential piping welds with a nominal pipe size greater than or equal to four inches as defined in Figure IWB-2500-8.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWB-2500-1, Examination Category B-J, for the following cast stainless steel circumferential piping welds:

Unit	Weld Numbers
1	RC-02, RC-10, RC-11, RC-12, RC-18, RC-22, and RC-23
2	RC-15, RC-02, RC-23, and RC-35

Licensee's Basis for Requesting Relief (as stated):

"The ultrasonic examination of the piping welds are limited due to physical configuration and cast stainless steel material. The limitations are noted on the ultrasonic examination data sheet and Attachment A\* of this request for relief. The physical configuration at structural discontinuities (elbow to nozzle, elbow to pipe, pump to elbow, etc.) may create scan limitations preventing 100 percent code examination coverage. In addition the reactor coolant main loop piping is fabricated of cast stainless steel with a nominal wall thickness ranging from 2.69 inches nominal wall (NW) for cold leg, 2.84 inches NW for hot leg, and 2.99 inches NW for the crossover leg. Current ultrasonic capabilities are not sufficient to examine cast stainless materials of this thickness. Due to the physical configuration and material type, these piping welds were ultrasonically examined, but unable to achieve essentially 100 percent code coverage."

Licensee's Proposed Alternative (as stated):

"TVA performed a surface examination on essentially 100% of the weld and an ultrasonic examination on the accessible areas of these welds."

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\*Not included with this evaluation.

Evaluation: The Code requires 100% volumetric examination of the subject Code Item B9.11 circumferential piping welds. From review of the supporting information, it has been determined that the scanning surface geometry and piping material (cast stainless steel) prevent full examination coverage and make the volumetric examinations impractical to perform to the extent required by the Code. Design modifications are necessary to sufficiently improve the geometry and material acoustic properties of the piping to allow a complete examination. Imposition of this requirement would cause a considerable burden on the licensee.

Based on the 14% to 85% (average of 49%) volumetric examination coverage achieved and the 100% surface examinations that were performed on the subject welds, in combination with examinations performed on similar items, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

B. Requests for Relief 1-ISI-20 and 2-ISI-20, Examination Category B-J, Item B9.31, Piping Branch Connection Welds

Code Requirement: Table IWB-2500-1, Examination Category B-J, Item B9.31, requires 100% volumetric and surface examinations of piping branch connection welds greater than 2 inches NPS as defined by Figures IWB-2500-9, -10 and -11.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWB-2500-1, Examination Category B-J, for the following branch connection piping welds:

Unit	Weld Numbers
1	CVCW-3, RCW-01, RCW-22, SIW-05, RHRW-02, RCW-14, and SIW-08
2	RCW-01, RCW-22, RHRW-02, and SIW-09

Licensee's Basis for Requesting Relief (as stated):

"The ultrasonic examination of the branch connection welds are limited due to the design configuration (i.e. the branch connection being "set on" the reactor coolant main loop piping). Also the reactor coolant main loop piping is cast material. The limitations are noted on the ultrasonic examination data sheet and Attachment A\* of this request for relief. The configuration of the branch connection being set on the reactor coolant main loop piping, which is fabricated of thick wall cast stainless material, is not amenable to ultrasonic examination. Due to the branch connection configuration and material type, current ultrasonic examination techniques are not sufficient to achieve essentially 100 percent code coverage of these branch connection piping welds."

Licensee's Proposed Alternative (as stated):

"TVA performed a surface examination on essentially 100% of the weld and an ultrasonic examination on accessible areas of these welds."

Evaluation: The Code requires 100% volumetric examination of the subject Code Item B9.31 branch connection welds. From review of the supporting information, it has been determined that the scanning surface geometry and piping material (cast stainless steel) prevent full examination coverage and make the volumetric examinations impractical to perform to the extent required by the Code. Design modifications are necessary to sufficiently improve the geometry and material acoustic properties of the branch connections and piping to allow a complete examination. Imposition of this requirement would cause a considerable burden on the licensee.

Based on the 25% to 85% (average of 65%) volumetric examination coverage and the 100% surface examinations that were performed on the subject welds, in combination with examinations performed on similar items, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

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\*Not included with this evaluation.

C. Requests for Relief 1-ISI-21 and 2-ISI-21, Examination Category B-D, Item B3.110, Pressurizer Nozzle-to-Vessel Full Penetration Welds

Code Requirement: Table IWB-2500-1, Examination Category B-D, Item B3.110, requires 100% volumetric examination of full penetration nozzle-to-vessel welds as defined by Figure IWB-2500-7.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWB-2500-1, Examination Category B-D, for pressurizer nozzle-to-vessel welds RCW-15, RCW-16, RCW-17, RCW-18, RCW-19, and RCW-21 in each unit.

Licensee's Basis for Requesting Relief (as stated):

"The ultrasonic examination of the pressurizer nozzle-to-vessel welds are limited due to the configuration of the pressurizer nozzle. The limitations are noted on the ultrasonic examination data sheet and Attachment A\* of this request for relief. The configuration of the pressurizer nozzle to head prevents ultrasonic scanning techniques from the nozzle side of the pressurizer nozzle to vessel weld."

Licensee's Proposed Alternative (as stated):

"TVA performed an ultrasonic examination on accessible areas of the nozzle-to-vessel welds from the vessel head side of the weld."

Evaluation: The Code requires 100% volumetric examination of the subject nozzle-to vessel welds. From review of the supporting information, it has been determined that the nozzle scanning surface geometry and pressurizer configuration prevent full examination coverage and make the volumetric examinations impractical to perform to the extent required by the Code. Examinations are limited to the vessel side of the welds by the nozzle and pressurizer configuration. Design modifications are necessary to sufficiently improve the geometry of the nozzles to allow a complete examination. Imposition of this requirement would cause a considerable burden on the licensee.

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\*Not included with this evaluation.

Based on the 50% volumetric examination coverage of the subject welds, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

D. Requests for Relief 1-ISI-22 and 2-ISI-22, Examination Category B-F, Items B5.20 and B5.30, Dissimilar Metal Welds

Code Requirement: Table IWB-2500-1, Examination Category B-F, Items B5.20 and B5.30, requires 100% volumetric and surface examinations of pressure-retaining dissimilar metal welds as defined by Figure IWB-2500-8.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWB-2500-1, Examination Category B-F, for the following steam generator and pressurizer nozzle safe end dissimilar metal welds:

Unit	Weld Numbers
1	RC-02-SE, RC-03-SE, RC-10-SE, RC-11-SE, RC-18-SE, RC-19-SE, RC-26-SE, RC-27-SE, RCW-24-SE, RCW-28-SE, and RCW-29-SE
2	RC-02-SE, RC-03-SE, RC-10-SE, RC-11-SE, RC-18-SE, RCW-25-SE, RCW-26-SE, RCW-27-SE, RCW-28-SE, and RCW-29-SE

Licensee's Basis for Requesting Relief (as stated):

"The ultrasonic examination of the pressurizer nozzle-to-safe end welds and the S/G nozzle-to-safe end welds are limited due to the design configuration and cast stainless material. Due to the design configuration, no ultrasonic examination was performed from the nozzle side on each weld. Additional limitations were noted on the S/G safe end due to the cast stainless material. The limitations are noted on the ultrasonic examination data sheet and Attachment A\* of this request for relief.

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\*Not included with this evaluation.



"The reasons for the limited American Society of Mechanical Engineers Code examination coverage of the subject welds are listed below:

- "a. Sequoyah Nuclear Plant (SQN) Units 1 and 2 steam generator (S/G) bottom head is a single piece casting, (SA-216 material) with integral cast nozzles. The Westinghouse Electric Corporation design of the nozzle safe-end welds consist of approximately 0.5-inch layer of TY-308-L weld material (buttering) applied to the nozzle weld edge preparation surface. During the first interval, TVA identified the safe-end as an examination Category B-F weld, separate from the adjacent examination Category B-J circumferential pipe weld. Because of the safe-end weld configuration, access was extremely limited (see Sketch #1").
- "b. The design configuration of the nozzles does not permit scanning from the nozzle side of the safe-end-weld (see sketch #2").
- "c. The primary loop piping connections at all eight S/G nozzle safe-ends are elbows (i.e., nozzle to static cast stainless fitting) causing an ultrasonic coupling problem when utilizing the large "foot-print" transducers that are required to penetrate the cast stainless material. No examination credit was taken when transducer lift-off was observed due to the rough surface condition of the cast elbow.
- "d. Because of the location of the safe-end weld relative to the transducer location during circumferential scans, no examination credit was taken for circumferential scans due to the "squint" angle of the transducers not allowing the sound beam to impinge on the area of the safe-end weld (see sketch #3").

"The ultrasonic examination (UT) techniques used are as follows:

- "a. The optimum techniques available were utilized (i.e., large, low frequency, 45-degree longitudinal wave in the pitch catch mode). Because of the high levels of attenuation and noise from scanning at grain boundaries, no other techniques available would increase the coverage.
- "b. The UT examination was performed utilizing two, one-inch diameter, one megahertz transducers that produced a 45-degree longitudinal wave in the part. The transducers were mounted on a Lucite wedge in a side-by-side, dual, pitch-catch configuration (see sketch #4").

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\*Not included with this evaluation.

- \*c. The calibration was established utilizing the half-vee technique. The calibration block material was SA-351 GR C1-8A, and was the same nominal thickness and diameter as the piping examined.
- \*d. Scans were performed in the axial direction from the elbow side of the weld. No credit was taken for the circumferential scans due to the "squint" angle of the dual transducers."

Licensee's Proposed Alternative (as stated):

"TVA performed a surface examination on essentially 100% of the weld and an ultrasonic examination on accessible areas of the pressurizer and S/G nozzle-to-safe end welds."

Evaluation: The Code requires 100% volumetric examination of dissimilar metal welds. Review of the supporting information for the subject steam generator nozzle-to-safe end welds showed that the nozzle scanning surface geometry and cast material limit the examinations. Examinations are limited to the safe end side of the weld by nozzle configuration and to  $\frac{1}{2}$  vee by the cast material, which requires large refracted L-wave transducers. For the subject pressurizer nozzle-to-safe end welds, the configuration of the nozzles limits the examination coverage to the safe end side of the welds. Therefore, the volumetric examinations are impractical to perform to the extent required by the Code. Design modifications are necessary to sufficiently improve the geometry and material acoustic properties of the nozzle and piping to allow a complete examination. Imposition of this requirement would cause a considerable burden on the licensee.

Based on the 100% surface examinations and the 12% to 25% (average of 22%) volumetric examinations that were performed on the steam generator nozzle-to-safe end welds and the 50% to 75% coverage (average of 72%) volumetric examinations that were performed on the pressurizer nozzle-to-safe end welds, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

E. Requests for Relief 1-ISI-23 and 2-ISI-23, Examination Category C-B, Item C2.20, Pressure-Retaining Nozzle Welds in Vessels

Code Requirement: Table IWC-2500-1, Examination Category C-B, Item C2.20, requires 100% volumetric examinations of nozzles in vessels over  $\frac{1}{2}$  inch nominal thickness as defined by Figure IWC-2500-4.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWC-2500-1, Examination Category C-B, for the following nozzle-to-vessel welds:

Unit	Weld Numbers
1	FDW-1, FDW-2, FDW-3, FDW-4, MSW-1, MSW-2, MSW-3, MSW-4, BIT-1, and BIT-5
2	FDW-1, FDW-2, FDW-3, FDW-4, MSW-1, MSW-2, MSW-3, MSW-4, BIT-2, and BIT-5

Licensee's Basis for Requesting Relief (as stated):

"The ultrasonic examination of the S/G and centrifugal charging pump tank nozzle-to-vessel welds are limited due to the design configuration. No ultrasonic examination was performed from the nozzle side on each weld. The limitations are noted on the ultrasonic examination data sheets and on Attachment A\* of this request for relief.

Licensee's Proposed Alternative (as stated):

"TVA performed a surface examination on essentially 100% of the weld and an ultrasonic examination on accessible areas of the S/G and centrifugal charging pump tank nozzle-to-vessel welds."

Evaluation: The Code requires 100% volumetric examination of nozzle-to-vessel welds. However, scans are limited to the vessel side of the welds by the nozzle configuration. Thus, the nozzle scanning surface geometry prevents full examination coverage and makes the volumetric examinations impractical to perform to the extent required by the Code. Design modifications are necessary to sufficiently improve the geometry of the nozzles to allow a complete examination. Imposition of this requirement would cause a considerable burden on the licensee.

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\*Not included with this evaluation.

Based on the 100% surface examinations and the 75% volumetric examinations that were performed on these welds, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(1).

F. Request for Relief 1-ISI-24 and 2-ISI-24, Examination Category C-A, Item C1.20, Pressure-Retaining Welds in Pressure Vessels

Code Requirement: Table IWC-2500-1, Examination Category C-A, Item C1.20, requires 100% volumetric examinations of pressure-retaining welds in pressure vessels.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWC-2500-1, Examination Category C-A, for RHR vessel head-to-shell weld segments RHRW-17-A-1, RHRW-17-A-2, and RHRW-17-A-3 for each unit.

Licensee's Basis for Requesting Relief (as stated):

**Unit One**

"Each RHR heat exchanger consists of an inlet-outlet head chamber with one inlet and one outlet nozzle, two integrally attached support brackets, and a circumferential vessel head-to-shell weld. The design configuration of the head, nozzles, and support brackets restricts examination of the head-to-shell weld. The vessel head-to-shell weld is 113 inches in length. The weld examinations are distributed in three segments, identified as: RHRW-17-A-1, 37 in.; RHRW-17-A-2, 38 in., and RHRW-17-A-3, 38 in. RHRW-17-A-1 was examined ultrasonically in the first inspection period. RHRW-17-A-2 was examined in the second period. RHRW-17-A-3 was examined during the third period. Based on the examinations performed, 80% examination volume coverage of the RHR heat exchanger circumferential head-to-shell weld was achieved. These limitations are noted on the ultrasonic examination data sheet and on Attachment A of this request for relief."

**Unit Two**

"Each RHR heat exchanger consists of an inlet-outlet head chamber with one inlet and one outlet nozzle, two integrally attached

support brackets and a circumferential vessel head-to-shell weld. The design configuration of the head, nozzles, and support brackets restricts examination of the head-to-shell weld. The vessel head-to-shell weld is 113 in. in length. The weld examinations are distributed in three segments, identified as: RHRW-17-A-1, 37 in.; RHRW-17-A-2, 38 in.; and RHRW-17-A-3, 38 in. RHRW-17-A-1 was ultrasonically examined in the first inspection period. RHRW-17-A-2 was examined in the second period. RHRW-17-A-3 was examined during the third period. Based on the examinations performed, 75% examination volume coverage of the RHR heat exchanger circumferential head-to-shell weld was achieved. These limitations are noted on the ultrasonic examination data sheet and on Attachment A\* of this request for relief."

Licensee's Proposed Alternative (as stated):

"TVA performed an ultrasonic examination on the accessible areas on one head-to-shell circumferential weld on one RHR heat exchanger to achieve maximum code coverage with meaningful results."

Evaluation: The Code requires 100% volumetric examination of vessel welds. Review of the supporting information for the subject RHR vessel welds found that the design of the RHR heat exchanger prevents full examination coverage and makes the volumetric examinations impractical to perform to the extent required by the Code. Scanning is restrict by the configuration of head, nozzles, and support brackets. Design modifications are necessary to allow a complete volumetric examination of the vessel. Imposition of this requirement would cause a considerable burden on the licensee.

Based on the 65% to 80% (average of 77.5%) volumetric examination coverage of the welds, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

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\*Not included with this evaluation.

G. Requests for Relief 1-ISI-25 and 2-ISI-30.

10 CFR 50.55a(g)(6)(ii)(A), "Augmented Examination of Reactor Vessel", Examination Category B-A, Item B1.11, Reactor Vessel Bottom Head-to-Lower Shell Welds

Requirement: 10 CFR 50.55a(g)(6)(ii)(A), "Augmented Examination of Reactor Vessel", requires the examination of essentially 100% of reactor vessel shell welds specified in Item B1.10 of Examination Category B-A of the 1989 Edition of Section XI. Essentially 100% is defined as more than 90% in § 50.55a(g)(6)(ii)(A)(2).

§ 50.55a(g)(6)(ii)(A)(5) mandates that licensees who determine that they are unable to satisfy the augmented requirements propose an alternative to the examination requirements that would provide an acceptable level of quality and safety.

Licensee's Relief Request: The licensee proposed an alternative to the augmented reactor pressure vessel weld volumetric coverage, as defined by Figure IWB-2500-1, for the reactor vessel bottom head-to-lower shell weld (weld number W02-03) for both units, where essentially 100% volumetric coverage was not obtained.

Licensee's Basis for Requesting Relief (as stated):

"Access Limitations - Examination from Interior Surface

"The design configuration of the reactor vessel core support lugs (6) places limitations on the ultrasonic examination of the bottom head to lower shell weld (W02-03) from the vessel interior surface. Automated ultrasonic examinations were performed by Southwest Research Institute on all accessible areas of the bottom head to lower shell weld. The ultrasonic examination techniques provided below were used:

- "1 . 0-degree longitudinal-wave examinations were performed for detection of laminar reflectors that might affect interpretation of angle-beam results.
- "2. 0-degree longitudinal-wave examinations were performed for detection of reflectors in the weld and base material.
- "3. 45 and 60 degree shear-wave examinations were performed for detection of reflectors orientated parallel to the weld axis and located in the weld and base material.

- "4. 45 and 60 degree shear-wave examinations were performed for detection of reflectors orientated transverse to the weld axis and located in the weld and base material.
- "5. 50/70 degree bi-modal examination techniques were used to examine for reflectors in the clad-to-base interface region and the inner 25% of material. These examinations were performed to detect reflectors orientated both parallel and transverse to the weld axis.

"Access Limitations - Examination from Exterior Surface

"Ultrasonic examinations for the reactor vessel external surface on the bottom head to lower shell weld are impractical due to the extremely high radiation dose rates. In addition, the access to the reactor vessel bottom head lower shell weld is extremely limited due to the reactor vessel insulation, biological shield wall around the vessel and incore instrumentation at the bottom of the vessel. Based on the above limitations and high dose rates, it is impractical to perform ultrasonic examinations of the reactor vessel bottom head to lower shell weld (W02-03) from the external surface of the reactor vessel.

"Extent of Examination Achieved

"The accessible portions of the reactor vessel bottom head to shell weld (W02-03) were ultrasonically examined from the vessel interior. Because of the limited access between the vessel and biological shield wall, conducting the examinations from the external surfaces for the purpose of investigating the small amount of weld volume missed during the ultrasonic examinations from the interior surface would require the destruction of the insulation during the removal process, excessive radiation doses, and substantial costs without providing any substantial increase in the quality and safety of the units."

Licensee's Proposed Alternative (as stated):

**Unit One**

"TVA utilized 0°, 45°, 60°, 50°/70° scans oriented clockwise, counterclockwise, up and down of the bottom-head to lower-shell weld to achieve ≥ 90 percent code examination coverage for reflectors oriented parallel to the weld and 67 percent code examination coverage for reflectors oriented transverse to the weld."

**Unit Two**

"TVA utilized 0°, 45°, 60°, 50°/70° scans oriented clockwise, counterclockwise, up and down of the bottom-head to lower-shell weld to achieve 73 percent code examination coverage for reflectors oriented parallel to the weld and 70 percent code examination coverage for reflectors oriented transverse to the weld."

Evaluation: For compliance with the augmented reactor vessel examination requirements, the licensee must volumetrically examine essentially 100% ( $\geq 90\%$ ) of the subject Item B1.11 shell welds. However, the core support lugs in the Sequoyah Units 1 and 2 reactor pressure vessels interfere with these examinations. There are also significant limitations to implementing alternative examination methods for increased coverage. Therefore, essentially 100% coverage of the subject reactor pressure vessel welds is not feasible. To obtain complete volumetric coverage, design modifications or replacement of the components with ones of a design providing for complete coverage would be required. Imposition of this requirement would cause a considerable burden on the licensee.

The volumetric examinations of the subject reactor pressure vessel shell welds were performed to the extent practical from the inside surface using mechanized inspection equipment. Considering the examinations performed on these welds and the complete examinations of other Item B1.10 beltline welds, the INEL staff believes that the examination coverage obtained is sufficient to detect any existing patterns of degradation.

Examination from the external surface of the vessel is not feasible because of limited access between the vessel and the bioshield and the burden associated with the high radiation levels. Assuming access could be attained, the additional examination coverage would be insignificant compared with the percentage already examined. Therefore, the INEL staff concludes that imposing additional examinations from the external surface would result in a considerable burden without a substantial increase in quality and safety.

Based on review of the information submitted, it is concluded that the licensee has maximized examination coverage to the extent practical, and that the licensee's proposed alternative augmented reactor pressure vessel examination should be authorized pursuant to 10 CFR 50.55a(a)(3)(ii).



H. Requests for Relief 1-ISI-26 and 2-ISI-31, Examination Category B-A, Item B1.30, Reactor Vessel Shell-to-Flange Welds

Code Requirement: Table IWB-2500-1, Examination Category B-A, Item B1.30, requires 100% volumetric examination of reactor vessel shell-to-flange welds as defined by Figure IWB-2500-4.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWB-2500-1, Examination Category B-A, for reactor vessel shell to flange Weld W06-07 for each unit.

Licensee's Basis for Requesting Relief (as stated):

"The ultrasonic examination of the reactor vessel upper shell to flange weld, (W06-07) is limited due to the design configuration. The upper shell to flange weld has limitations on the shell side due to the reactor vessel nozzle locations and on the flange side due to the keyway location. The limitations are noted on the ultrasonic examination data sheets and Attachment A\* of this request for relief."

Licensee's Proposed Alternative (as stated):

**Unit One**

"TVA utilized 0°, 45°, 60°, 50°/70° scans oriented clockwise, counterclockwise, up and down of the upper shell to flange weld, to achieve 85% code examination coverage for reflectors oriented parallel to the weld and 65% code examination coverage for reflectors oriented transverse to the weld."

**Unit Two**

"TVA utilized 0°, 45°, 60°, 50°/70° scans oriented clockwise, counterclockwise, up and down of the upper shell to flange weld, to achieve ≥ 90% code examination coverage for reflectors oriented parallel to the weld and 65% code examination coverage for reflectors oriented transverse to the weld."

Evaluation: The Code requires 100% volumetric examination of reactor vessel welds. However, the design of the reactor vessels (the reactor vessel nozzle locations and, on the flange side, the keyway location) prevents full examination coverage; therefore, the

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\*Not included with this evaluation.

volumetric examinations are impractical to perform to the extent required by the Code. To perform the required ultrasonic examination of the entire volume of the welds would require design modifications. Imposition of this requirement would cause a considerable burden on the licensee.

Based on the 85% (Unit 1) and 90% or greater (Unit 2) volumetric examination coverage for reflectors oriented parallel to the welds and the 65% (both units) volumetric examination coverage for reflectors oriented perpendicular to the welds, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

I. Requests for Relief 1-ISI-27 and 2-ISI-29, Examination Category B-D, Item B3.90, Reactor Vessel Outlet Nozzle Welds

Code Requirement: Table IWB-2500-1, Examination Category B-D, Item B3.90, requires 100% volumetric examination of full penetration nozzle-to-vessel welds.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWB-2500-1, Examination Category B-D, for outlet nozzle-to-reactor vessel welds N-15, N-16, N-17, and N-18 for each unit.

Licensee's Basis for Requesting Relief (as stated):

"The ultrasonic examination of the reactor vessel outlet nozzle to vessel welds (N-15,-16,-17, and -18) are limited due to the design configuration, (i.e., the integral extensions and the location of the adjacent nozzles). The limitations are noted on the ultrasonic examination data sheets and Attachment A\* of this request for relief."

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\*Not included with this evaluation.

Licensee's Proposed Alternative (as stated):

**Unit One**

"TVA utilized 0°, 45°, 60°, 50°/70°, and 10° examinations to achieve 100% code examination coverage for reflectors parallel to the weld. For reflectors transverse to the weld, code examination coverage for N-15 is 55%, N-16 is 39%, N-17 is 46%, and N-18 is 37%."

**Unit Two**

"TVA utilized 0°, 45°, 60°, 50°/70° and 10° examination to achieve 100% code examination coverage for reflectors parallel to the weld. For reflectors transverse to the weld, code examination coverage for N-15 is 80%, N-16 is 71%, N-17 is 71%, and N-18 is 71%."

Evaluation: The Code requires 100% volumetric examination of nozzle-to-vessel welds. However, the design of the reactor vessel and nozzles (integral extensions and locations of adjacent nozzles) prevents full examination coverage and makes the volumetric examinations impractical to perform to the extent required by the Code. To perform the required ultrasonic examination of the entire volume of the welds, the reactor vessel and nozzles would require design modification. Imposition of this requirement would cause a considerable burden on the licensee.

Based on the 100% volumetric examination coverage for reflectors oriented parallel to the welds and the 37% to 80% (average of 59%) volumetric examination coverage for reflectors oriented perpendicular to the welds, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

J. Request for Relief 2-ISI-32, Examination Category C-A, Item C1.10, Weld in Centrifugal Charging Pump Tank Vessel

Code Requirement: Table IWC-2500-1, Examination Category C-A, Item C1.10, requires 100% volumetric examination of pressure-retaining welds in vessels as defined in Figure IWC-2500-1.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWC-2500-1, Examination Category C-A, for shell-to-lower head vessel Weld BIT-4 of Unit 2.

Licensee's Basis for Requesting Relief (as stated):

"The ultrasonic examination of the centrifugal charging pump tank head to shell weld is limited due to the design configuration. The centrifugal charging pump tank consists of two circumferential shell welds, one inlet nozzle, one outlet nozzle, and four integrally welded support attachments. The design configuration restricts ultrasonic examination of circumferential head to shell weld, BIT-4. The limitations are noted on the ultrasonic examination data sheets and on Attachment A\* of this request for relief. TVA performed an ultrasonic examination to achieve maximum code examination volume coverage and with meaningful results, 79 percent examination volume coverage was achieved."

Licensee's Proposed Alternative (as stated):

"TVA performed an ultrasonic examination on the accessible areas of the centrifugal charging pump tank circumferential head to shell weld."

Evaluation: The Code requires 100% volumetric examination of the subject vessel welds. However, the design of the vessel (four integrally welded support attachments to the tank) prevents full examination coverage and makes the volumetric examinations impractical to perform to the extent required by the Code. Design modification of the vessel would be required to allow ultrasonic examination of the entire volume of the weld. Imposition of this requirement would cause a considerable burden on the licensee.

Based on the 79% volumetric examination coverage of the weld, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

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\*Not included with this evaluation.

K. Request for Relief 2-ISI-26, Examination Category C-F, Item C5.21, Pressure-Retaining Circumferential Weld in Piping

Code Requirement: Table IWC-2500-1, Examination Category C-F, Item C5.21, requires 100% volumetric examination of pressure-retaining welds in piping over  $\frac{1}{2}$  inch nominal wall thickness as defined in Figure IWC-2500-7.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWC-2500-1, Examination Category C-F, for flange-to-main steam header six-inch piping Weld MSS-32 for Unit 2.

Licensee's Basis for Requesting Relief (as stated):

"The ultrasonic examination of the 6 in. circumferential flange to main steam piping header weld (MSS-32) is limited due to the design configuration. The limitations are noted on the ultrasonic examination data sheets and Attachment A\* of this request for relief."

Licensee's Proposed Alternative (as stated):

"TVA performed a surface examination on essentially 100% of the weld and an ultrasonic examination on accessible areas of the 6-in. circumferential flange to main steam pipe header weld, MSS-32."

Evaluation: The Code requires 100% volumetric examination of the subject piping weld. However, the design of the piping connection prevents full examination coverage (scan restrictions due to geometry) and makes the volumetric examination impractical to perform to the extent required by the Code. Ultrasonically examining the entire volume of the weld would require design modification. Imposition of this requirement would cause a considerable burden on the licensee.

Based on the 75% volumetric examination coverage of the weld, in combination with examinations performed on similar piping welds, it is concluded that significant degradation, if present, would have

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\*Not included with this evaluation.

been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

L. Request for Relief 2-ISI-27, Examination Category C-C, Item C3.10, RHR Heat Exchanger Integrally-Welded Attachment

Code Requirement: Table IWC-2500-1, Examination Category C-C, Item C3.10, requires 100% volumetric examination of integrally-welded support attachments as defined in Figure IWC-2520-5.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWC-2500-1, Examination Category C-C, for welded support attachment to the RHR heat exchanger head RHRW-19-A-IA for Unit 2.

Licensee's Basis for Requesting Relief (as stated):

"The surface examination of the RHR heat exchanger integrally welded support attachment is limited due to the design configuration of the RHR heat exchanger head and integrally welded support attachment. The limitations are noted on the examination data sheet and on Attachment A of this request for relief."

Licensee's Proposed Alternative (as stated):

"TVA performed a surface examination on the accessible areas of the RHR heat exchanger integrally welded support attachment weld, RHRW-19A-IA."

Evaluation: The Code requires 100% surface examination of the subject attachment weld. However, the configuration of the attachment connection prevents full examination coverage and makes the surface examination impractical to perform to the extent required by the Code. To perform the required surface examination of the entire weld of the attachment, the vessel and attachment would require design modification. Imposition of this requirement would cause a considerable burden on the licensee.

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\*Not included with this evaluation.

Based on the 75% surface examination of the weld, in combination with examinations performed on similar attachment welds, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

M. Request for Relief 2-ISI-28, Examination Category C-C, Item C3.40, Class 2 Feedwater Piping Integrally-Welded Support Attachment

Code Requirement: Table IWC-2500-1, Examination Category C-C, Item C3.40, requires 100% volumetric examination of integrally-welded support attachments as defined in Figure IWC-2520-5.

Licensee's Code Relief Request: The licensee requested relief from the examination coverage required by Table IWC-2500-1, Examination Category C-C, for welded support attachment to feedwater piping Weld Number 2-FDH-204-IA for Unit 2.

Licensee's Basis for Requesting Relief (as stated):

"Due to the design of the piping support, a surface examination cannot be performed on the integrally welded attachment. The four integrally welded attachments have access limitations due to nonremovable pipe clamp interferences. Access to the integrally welded attachments would require removing support brackets for each support attachment lug and removing the pipe clamp by cutting out support welds. The removal of the pipe clamp on the 16-in. diameter pipe is also limited due to the physical location to all pipe penetration and the location to the floor. These limitations are noted on the surface examination data sheet and on the Attachment A\* of this request for relief."

Licensee's Proposed Alternative (as stated):

"TVA performed VT-3 examination on the integrally welded support attachment, 2-FDH-204-1A. A VT-3 was performed to determine the general mechanical condition and structural integrity of the attachments."

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\*Not included with this evaluation.

Evaluation: The Code requires 100% surface examination of the subject attachment weld. However, the design of the attachment connection makes the examination impractical. To perform the surface examination, the piping, support, and attachment would require design modification. Imposition of this requirement would cause a considerable burden on the licensee.

Based on the VT-3 examination that was performed on the weld, in combination with surface examinations performed on similar attachment welds, it is concluded that significant degradation, if present, would have been detected. As a result, reasonable assurance of operational readiness has been provided. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

### 3.0 CONCLUSION

The INEL staff has reviewed the licensee's requests for relief and determined that in these cases the Code examination requirements are impractical for the Sequoyah Nuclear Plant, Units 1 and 2. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i) for Relief Requests 1-ISI-19, 1-ISI-20, 1-ISI-21, 1-ISI-22, 1-ISI-23, 1-ISI-24, 1-ISI-26, 1-ISI-27, 2-ISI-20, 2-ISI-21, 2-ISI-22, 2-ISI-23, 2-ISI-24, 2-ISI-25, 2-ISI-26, 2-ISI-27, 2-ISI-28, 2-ISI-29, 2-ISI-31, and 2-ISI-32. For Relief Requests 1-ISI-25 and 2-ISI-30, it is recommended that the licensee's alternative to 100% coverage be authorized pursuant to 10 CFR 50.55a(a)(3)(ii).