Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

November 25, 2003

10 CFR 50.55a(a)(3)(i)

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Gentlemen:

In the Matter of	) Docket Nos.	50-259 50-260
Tennessee Valley Authority	)	50-296 50-327
		50-328 50-390

BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3, SEQUOYAH NUCLEAR PLANT UNITS 1 AND 2, AND WATTS BAR NUCLEAR PLANT UNIT 1 - AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) BOILER AND PRESSURE VESSEL CODE, CODE CASE N-513 - EVALUATION CRITERIA FOR TEMPORARY ACCEPTANCE OF FLAWS IN CLASS 3 PIPING, SECTION XI, DIVISION 1, GENERIC REQUEST FOR RELIEF - GISI-3

Reference: Code of Federal Regulations (CFR), Title 10, Part 50, Section 55a, "Codes and Standards," Paragraph (b)(2)(xiii), "Flaws in Class 3 Piping," [10 CFR 50.55a(b)(2)(xiii)]

Pursuant to 10 CFR 50.55a(a)(3)(i), TVA is requesting relief from using the specific formula in ASME Code Case N-513 for the maximum allowable flaw width (W_m) for when planar flaw evaluation rules may be applied, because it is unduly restrictive. As an alternative, TVA proposes to use the formula for W_m from Code Case N-513-1 with applicable errata while retaining the use of all the other provisions and requirements as shown in N-513. The formula for W_m in N-513-1 is the proper application, as discussed in the enclosed relief request. Code Case N-513 is conditionally approved for generic use by licensees in Revision 13 of NRC Regulatory Guide 1.147, "Inservice Inspection Code Case

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Acceptability, ASME Section XI, Division 1," and as shown in the referenced CFR paragraph. Code Case N-513-1, as approved and published in 2001 Edition and amended by errata in Supplement 5 to the ASME Boiler and Pressure Vessel Code Cases for Nuclear Components, is currently not approved for generic use in Regulatory Guide 1.147, Revision 13.

TVA's use of ASME Code Case N-513, as amended in the enclosed relief request, provides an acceptable level of quality and safety pursuant to the requirements of 10 CFR 50.55a(a)(3)(i).

Since TVA uses the Code Case N-513 methodology as a process for the evaluation of the structural integrity of degraded Class 3 piping, TVA requests approval of this relief as soon as practical.

There are no new regulatory commitments in this letter. If you have any questions, please contact Rob Brown at (423) 751-7228.

Sincerely,

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Enclosure: Generic Relief Request GISI-3
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ENCLOSURE

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN) UNITS 1, 2, 3
SEQUOYAH NUCLEAR PLANT (SQN) UNITS 1, 2
WATTS BAR NUCLEAR PLANT (WBN) UNIT 1

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) SECTION XI,
CODE CASE N-513,
EVALUATION CRITERIA FOR TEMPORARY ACCEPTANCE OF FLAWS IN CLASS 3 PIPING,
GENERIC REQUEST FOR RELIEF - GISI-3

EXECUTIVE SUMMARY:

In accordance with 10 CFR 50.55a(a)(3)(i), TVA is requesting relief from using certain requirements of the ASME Code Case N-513, "Evaluation Criteria for Temporary Acceptance of Flaws in Class 3 Piping, Section XI, Division 1," when performing the associated flaw evaluations. These evaluations are used to determine the temporary acceptance and allow continued use of the degraded Class 3 piping until such time that a code acceptable repair or replacement can be performed on the piping. Specifically, TVA proposes to use the formula for W_m as shown in the ASME published Code Case N-513-1 instead of the formula specified in N-513 (Revision 0) for computing the maximum width of a degraded flaw area (W_m), where planar flaw evaluation rules may be applied. TVA will apply this relief to the piping evaluations as necessary to support the temporary continued operation of applicable piping systems in BFN Units 1, 2, and 3; SQN Units 1 and 2; and in WBN Unit 1. The basis for using the equation from N-513-1 over the N-513 version of the formula for W_m is that the earlier version is unduly restrictive. The justification for this alternative is described in the discussion below.

Code Case N-513 is conditionally approved for generic use in Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1, Revision 13." Also, Code Case N-513 is approved for generic use by licensees in 10 CFR 50.55a(b)(2)(xiii).[1] Code Case N-513-1, as approved and published in 2001 Edition and amended by errata in Supplement 5 to the ASME Code Cases for Nuclear Components, is currently not approved for generic use in RG-1.147, Revision

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[1] 10 CFR 50.55a(b)(2)(xiii) - "Flaws in Class 3 Piping," Licensees may use the provisions of Code Case N-513, "Evaluation Criteria for Temporary Acceptance of Flaws in Class 3 Piping," Revision 0, and Code Case N-523-1, "Mechanical Clamping Devices for Class 2 and 3 Piping."

13. TVA will continue to apply the other remaining requirements of N-513 and the current specific use limitations in accordance with RG-1.147 and 10 CFR 50.55a(b)(2)(xiii).

SYSTEM/COMPONENT(S) FOR WHICH RELIEF IS REQUESTED:

Low to moderate energy Class 3 (or equivalent) pressure retaining piping subject to examination, evaluation, and repair or replacement using processes and procedures qualified to meet the ASME Section XI requirements. Low to moderate energy piping systems are defined by the ASME Code as systems whose maximum operating temperature does not exceed 200°F and maximum operating pressure does not exceed 275 psig.

CODE REQUIREMENTS:

In accordance with ASME Section XI, Article IWD-3000, "Acceptance Standards," (for Class 3 components) the rules of Article IWB-3000, "Acceptance Standards," (for Class 1 components) may be used. As stated in IWB-3000, the acceptance criteria for volumetric and surface examinations are defined in IWB-3500. For examination indications or flaws that exceed the acceptance criteria of IWB-3500, the flaws may be further analytically evaluated for acceptance in accordance with the requirements and procedures of Article IWB-3600 and the associated ASME Section XI appendices.

In accordance with the 10 CFR 50.55a(b)(2)(xiii), "Flaws in Class 3 Piping," licensees may use the provisions of ASME Code Case N-513, "Evaluation Criteria for Temporary Acceptance of Flaws in Class 3 Piping," Revision 0, provided the specific limitations delineated in 10 CFR 50.55a (b)(2)(xiii)(A) and (B) are followed. Code Case N-513 is also conditionally authorized for generic use by licensees through the RG-1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 13, dated June 2003. The conditions imposed on the use of N-513 in RG-1.147 are the same as those imposed in the CFR paragraphs cited above.

In accordance with the rules of Code Case N-513 paragraph 3.0(d)(1), when the flaw width, W_m, (in the area of the wall thinning that exceeds t_{min}) is less than or equal to $0.5(R_o t_{min})^{1/2}$; where R_o is the outside radius of the pipe, and W_m is defined in the attached illustration, the flaw can be classified as a planar flaw and evaluated under paragraphs 3.0(a) through 3.0(c) of the Code Case. In this N-513 equation, the variable, t_{min}, is equal to the minimum required wall thickness needed to maintain the integrity of the pipe for the given system pressure and is computed by the following formula:

$$t_{min} = \frac{pDo}{2(S + 0.4p)}$$

In this equation, p is defined as the maximum operating pressure at the flaw location, S is the allowable material stress at the operating temperature, and D_o is the outside diameter of the pipe.

RELIEF REQUESTED:

Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested to use the formula for W_m as shown in paragraph 3.0(d)(1) of Code Case N-513-1 (i.e., when the width, W_m, of the flaw in the area of the wall thinning that exceeds t_{min}, is less than or equal to $0.5(R_o t)^{1/2}$, where R_o is the outside radius of the pipe, and W_m is defined as shown in the attached illustration, then the flaw can be classified as a planar flaw and evaluated under paragraphs 3.0(a) through 3.0(c) of the Code Case N-513). In these cases, the value of t in this formula for W_m equals the pipe thickness used in the flaw evaluation model. This value of t is usually a measured value determined by nondestructive examinations thickness evaluation of the surrounding pipe wall area around the flaw, corrosion pit, or through-wall leak.

BASIS FOR RELIEF:

The formulas in question are the ones given in Article 3.0(d)(1) of both N-513 and N-513-1 for the quantity, W_m, that defines the maximum width of a degraded area where planar flaw evaluation rules may be applied.

Specifically, the formula for W_m given in Article 3.0(d)(1) of N-513 was revised in N-513-1 to replace the variable t_{min} with the variable t as follows:

$$W_m \le 0.5\sqrt{R_o t_{min}} \qquad \{\text{N-513}\}$$

$$W_m \le 0.5\sqrt{R_o t} \qquad \{\text{N-513-1, with errata}\}$$

In N-513, t_{min} is defined as the required thickness for pressure and is equal to:

$$\frac{pDo}{2(S + 0.4p)}$$

In N-513-1, t is defined as the pipe thickness used in flaw evaluation model.

It has previously been recognized by the ASME Committee that the improper use of the value t_{min} in the original formula given in N-513 resulted in a very limiting (i.e.,

unduly conservative) value of W_m because t_{min} is very small (usually < 0.1 inch) for the typical low pressure conditions found in raw water systems. In addition, if the value t_{min} is used to determine the value of W_m for piping evaluations of systems with high operating pressures, the resulting application of the planar flaw evaluation techniques could be under conditions that were not intended to be used with the Code Case alternative to the ASME Section XI evaluation rules shown in IWB-3600. The impact relative to use of Code Case N-513 is significant because the resulting value of W_m is, in most cases, too small to permit evaluation of the typical corrosion pitting observed in carbon steel raw water piping. This could result in unnecessary forced system and/or plant shutdowns in order to perform a Code repair or replacement of the degraded piping.

ALTERNATIVE EXAMINATION:

No specific alternative examination process is to be incorporated by this request. This request addresses the evaluation techniques (when using Code Case N-513) employed with the results from the standard Non-Destructive Examinations (NDE) techniques performed as part of the normally required ASME Section XI ISI program exams and augmented examinations performed under TVA's Corrosion Control Programs. TVA proposes to not use the formula in N-513 for computing the maximum width of a degraded flaw area (W_m), when the planar flaw evaluation rules may be applied, and instead use the formula for W_m as shown in the current ASME approved revision of the Code Case, N-513-1. TVA will apply the N-513-1 formula for calculation of the threshold value for use of evaluation techniques for planar flaws when the width, W_m, of the flaw in the area where the wall thinning exceeds t_{min}, is less than or equal to $0.5(R_o t)^{1/2}$, (R_o is the outside radius of the pipe, and W_m is defined as shown in the enclosure figure). TVA will apply this relief to the piping evaluations as needed to support the temporary continued operation of applicable piping systems in BFN Units 1, 2, and 3; SQN Units 1 and 2, and in WBN Unit 1.

JUSTIFICATION FOR GRANTING RELIEF:

The basis for using the N-513-1 equation over the N-513 version of the formula for W_m is that the previous Code Case version improperly uses the factor t_{min} to compute a value of W_m that unduly restricts the planar flaw evaluation rules with the low pressure Class 3 systems and defeats the purpose of the allowed alternatives. In addition, the value of t_{min} increases as system design pressure values increase. The effect on the value of W_m is to allow the use of planar flaw evaluation techniques on wide flaws where their use is not supported in all cases. The result is a condition that was not intended to be part of the

alternative evaluation methods because the W_m threshold value imposed with the N-513 formula becomes less restrictive as the required thickness for the piping design pressure increases. The use of the actual measured value of t in the formula for W_m will result in better representation of the structural integrity of the piping in the flawed areas and allow for the accurate application of the rules for temporary acceptance of the piping for continued service. As stated above, Code Case N-513 is currently approved for generic use in RG-1.147, Revision 13, and in 10 CFR 50.55a(b)(2)(xiii) with special limitations for use. Except for the formula for W_m, TVA will continue to apply the other remaining requirements of N-513 and the current specific limitations on its use as shown in RG-1.147, Revision 13, and in the rule.

It should also be noted that the planar flaw evaluation process contained in Code Case N-513 is very similar to the provisions of Generic Letter (GL) 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," which was issued for licensee use on June 15, 1990. GL 90-05 contained within its provisions the allowance for licensees to use one of two approaches in the evaluation and temporary acceptance of the structural integrity of flawed Class 3 piping. These two approaches included the "through-wall flaw" method and the "wall-thinning" method. Code Case N-513 currently employs much of the same evaluation technique as shown in the GL 90-05 through-wall flaw method. Specifically, the polynomial equation factors given in GL 90-05 to compute linear elastic crack stress intensity due to bending stresses are repeated and used in the linear elastic through-wall planar flaw evaluation techniques of both N-513 and N-513-1. This similarity indicates that the linear elastic fracture mechanics formula in both N-513 and N-513-1 will produce a crack stress intensity magnitude that is very close to the value produced by the formula in GL 90-05. The Code Case N-513/N-513-1 and GL 90-05 methodologies both contain similar acceptance criteria (i.e., structural margin relative to failure). In addition, the objective of both methods is to justify acceptability of a through-wall flaw without immediate physical repair/replacement.

However, even with the similarities, it is recognized that there are several substantive differences between the N-513/N-513-1 and GL 90-05 methods. In particular, the N-513 methodology does not impose a safety factor on crack stress intensity due to piping thermal expansion load, whereas GL 90-05 imposes the same safety factor for both primary and secondary loads. Thermal expansion stresses for piping within the scope of N-513 (i.e., 200°F maximum operating temperature) are generally low and not a significant contributor to crack stress intensity. Conversely, GL 90-05 only requires evaluation of a load combination involving safe shutdown earthquake effects (i.e., emergency or faulted plant conditions); whereas, the N-513/N-513-1 method includes consideration of the load combination involving

operating basis earthquake effects (i.e., upset plant condition) along with a correspondingly higher safety factor (2.77 vs. 1.39) on the stress intensity factor due to primary load. Because of this, experience has shown that the upset condition evaluation, as required by N-513, will generate a shorter (and more conservative) allowable flaw length than would be computed relative to either GL 90-05 or N-513 for just the emergency/faulted plant conditions. In addition, as part of its evaluation methods, GL 90-05 does not impose the restriction for the threshold of the application of the planar flaw evaluation techniques with a similar use of an equation for W_m as is imposed in N-513. Therefore, it can be concluded that when the alternative evaluation process is applied, the use of the N-513 provisions in conjunction with the alternative W_m formula using the value of t is more rigorous and conservative than the provisions of GL 90-05 and provides a similarly acceptable level of safety.

The use of the proposed alternatives described above in lieu of the formula for W_m, as shown in ASME Code Case N-513 and as delineated in 10 CFR 50.55a(b)(2)(xiii), will therefore provide an adequate level of quality and safety for the evaluation of the degraded piping and its continued acceptability for use with the through-wall flaw evaluation processes. Accordingly, approval of this alternative evaluation process is requested pursuant to 10 CFR 50.55a(a)(3)(i).

IMPLEMENTATION SCHEDULE:

This alternative will be used for BFN Units 1, 2, and 3; SQN Units 1 and 2, and WBN Unit 1 until the end of each unit's respective ten-year ISI Program interval when the unit's corresponding ISI and Repair and Replacements programs are updated; or until such time that the corrected Code Case is deemed acceptable for use in Regulatory Guide 1.147, and/or if 10 CFR 50.55a(b)(2)(xiii) is amended to reflect the correct formula for the application of the threshold values for the use of the planar flaw evaluation rules. Note that TVA currently performs, as a matter of procedure standardization, non-destructive examinations (NDE) on each of the plant's required components in accordance with the NDE methodology, acceptance criteria, and extent of examination requirements shown in the 1995 Edition of the ASME Section XI Code with the added requirements of the 1996 Addenda. The ASME Codes-of-Record used for the selection and scheduling of the components to be examined are indicated below.

The respective units' current ISI program intervals and ISI Program Codes-of-Record are as follows:

BFN Unit 1 is currently in the third period of its first 10-year ISI program interval and is in an extended shutdown. In accordance with the current Unit 1 ASME Section XI ISI Program Code-of-Record (1974 Edition through the 1975 Addenda) paragraph IWA-2400, the Unit 1 first ISI program interval will be extended by a period equal to the length of the extended shutdown. By letter dated March 1, 1988, TVA established that the current Unit 1 ISI program interval would be extended from its start on August 1, 1974 to a period of one year after restart of the unit. Unit 1 is currently scheduled for restart in May 2007.

BFN Unit 2 is currently in the first period of its third 10-year ISI program interval which extends from May 25, 2001 through May 24, 2011. The BFN Unit 2 ISI Program Code-of-Record is the ASME Section XI 1995 Code with addenda through the 1996 Addenda.

BFN Unit 3 is currently in the third period of its second 10-year ISI program interval which extends from November 19, 1996 through November 18, 2005. The BFN Unit 3 ISI Program Code-of-Record is the ASME Section XI 1989 Code with no addenda.

SQN Units 1 and 2 are currently in the third periods of their second program intervals which extend from December 16, 1995 through December 15, 2005. The SQN ISI Program Code-of-Record for both units is the 1989 Code.

WBN Unit 1 is currently in the second period of its first 10-year interval which extends from May 27, 1996 through December 31, 2006. The WBN ISI Program Code-of-Record is the 1989 Code.

Illustration of Nonplanar Flaw Due to Wall Thinning